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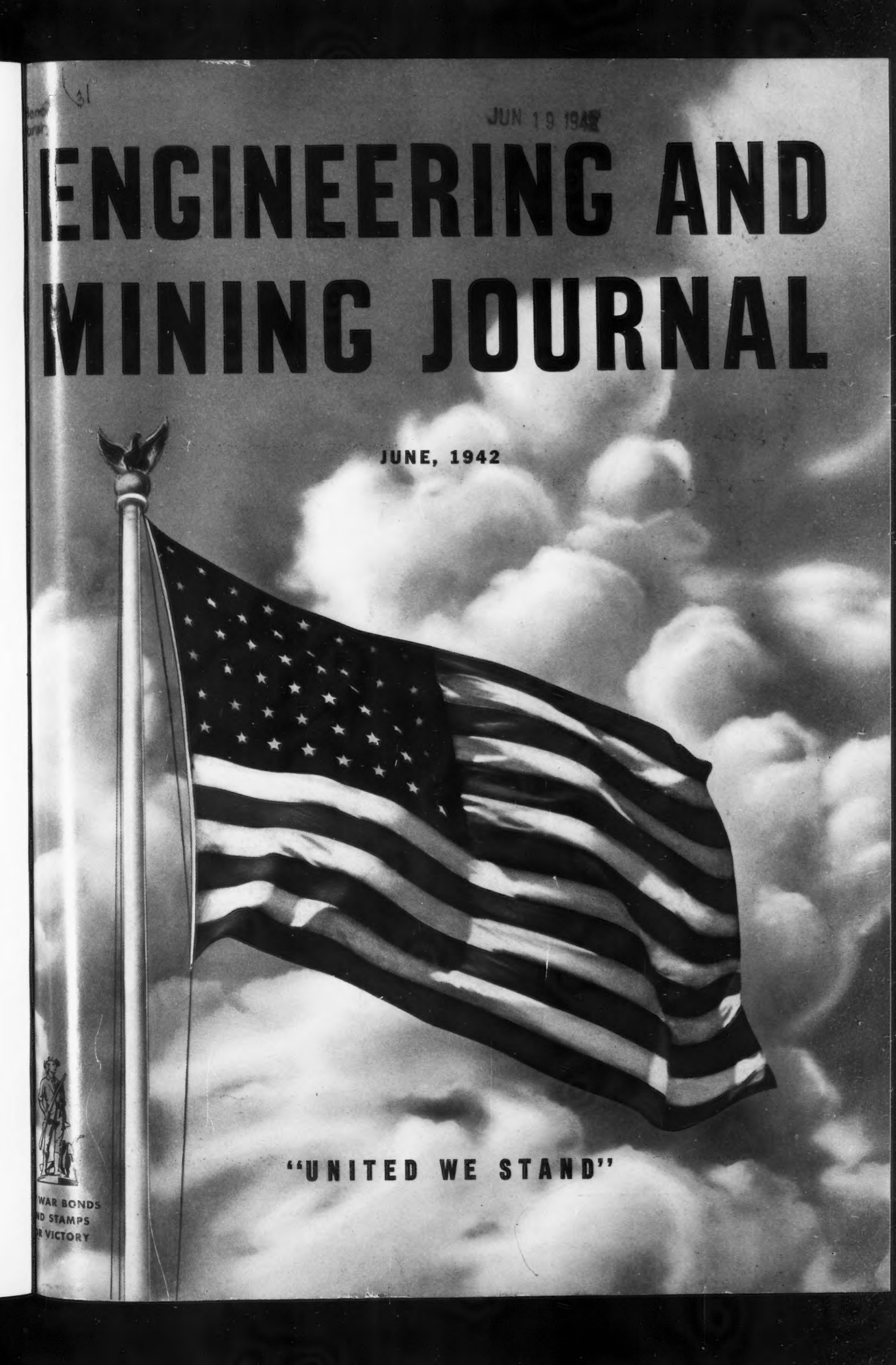
ENGINEERING AND MINING JOURNAL

JUNE, 1942

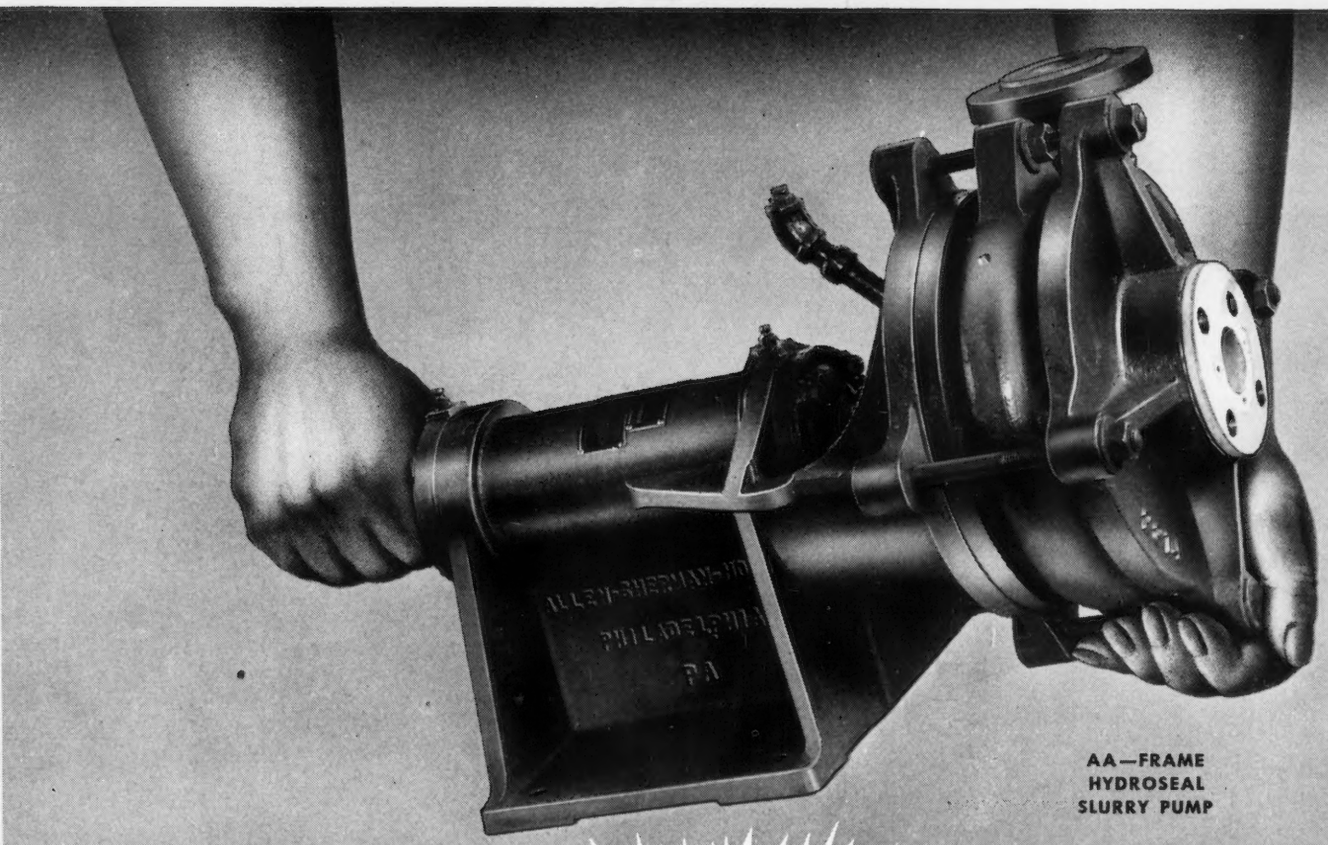


"UNITED WE STAND"

WAR BONDS
ND STAMPS
R VICTORY

TWO
RUNNING

TWO
STANDBYS

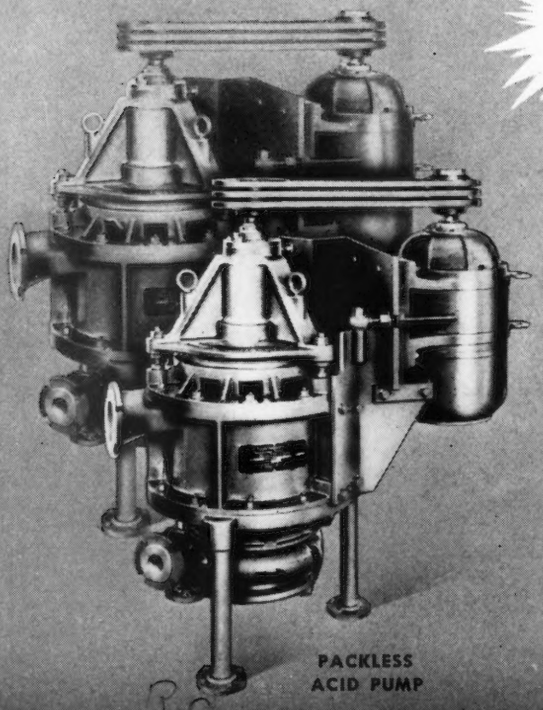


AA—FRAME
HYDROSEAL
SLURRY PUMP

HOT *Zinc Sulphate*

HANDLED BY

HYDROSEAL and PACKLESS PUMPS



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Mercurial changes in the market, suggesting the frolicksome habits of the metal, have long marked the mining of quicksilver in the United States. Reserves also have been uncertain. Dating from 1845, when New Almaden, in California, began production, the domestic output reached its zenith in 1877 at almost 80,000 flasks, approximately double the quantity turned out in 1941 at a considerably higher price. Today, as always, production comes from a large number of relatively small deposits. The present status of the industry will be outlined next month by Clyde P. Ross, U.S.G.S. geologist.

▼

The censor must be considered when the Nation is at war, and so it happens that publication of the article on the manganese possibilities of the Cuyuna Range, announced for inclusion in the current issue, has been held up until July.

▼

July topics also include: a method for planning the order and time of developing and mining the blocks at the optimum rate of draw in caving an orebody, by Tell Ertl—cyaniding flotation concentrates at the Batong-Buhay mine in the Philippines, by R. F. Brown—the Tungstar's new aërial tramway, by R. B. Williams.

▼

The Flag. This month we join with many other publishers in displaying on our cover the Flag of the United States of America. Thus, throughout the homes, offices, factories, and mines of the country the flag will be in mass evidence during July as the symbol of our way of life, of our national aim in the war, and of the victory that shall ultimately attend our arms. As the war progresses and the flag is more commonly displayed, due regard should be had for the Flag Code which defines the proper manner of displaying the flag. *E.&M.J.* will undertake to send a copy of the Code to readers who ask for it.

H. C. PARMELEE
Editor

ENGINEERING AND MINING JOURNAL

H. W. CLARKE
Vice-President

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Contents for JUNE 1942

Vol. 143, No. 6

Copyright 1942 McGraw-Hill Publishing Co., Inc.

Editorials 39

Reflections From Washington 41

Metering a Factor in I.M.C.'s Phosphate Operations 43
J. H. Edwards

Mining Tour of South America—IV 47
John B. Huttl

Truck Haulage in Mesabi Open-Pit Practice 52
R. W. Whitney

Timmins Ochali's Safety Work Headed by Management 55
Forbes K. Wilson and Balfour F. Darnell

The Double-Step Liner for Ball Mills 57
Warren L. Howes

Herman's Method for the Determination of Mercury 58
J. Moore Samuel

Filtering Cyanide Slimes 60
E. C. Bitzer

Concentrating Tungsten Ore by Hand in Bolivia 64
H. L. Dotson

Mine, Shop, and Plant 65

Useful Operating Ideas 68

Personals, Obituaries, Letters 71

Summary of the Markets 74

News of the Industry 77

Equipment News 110

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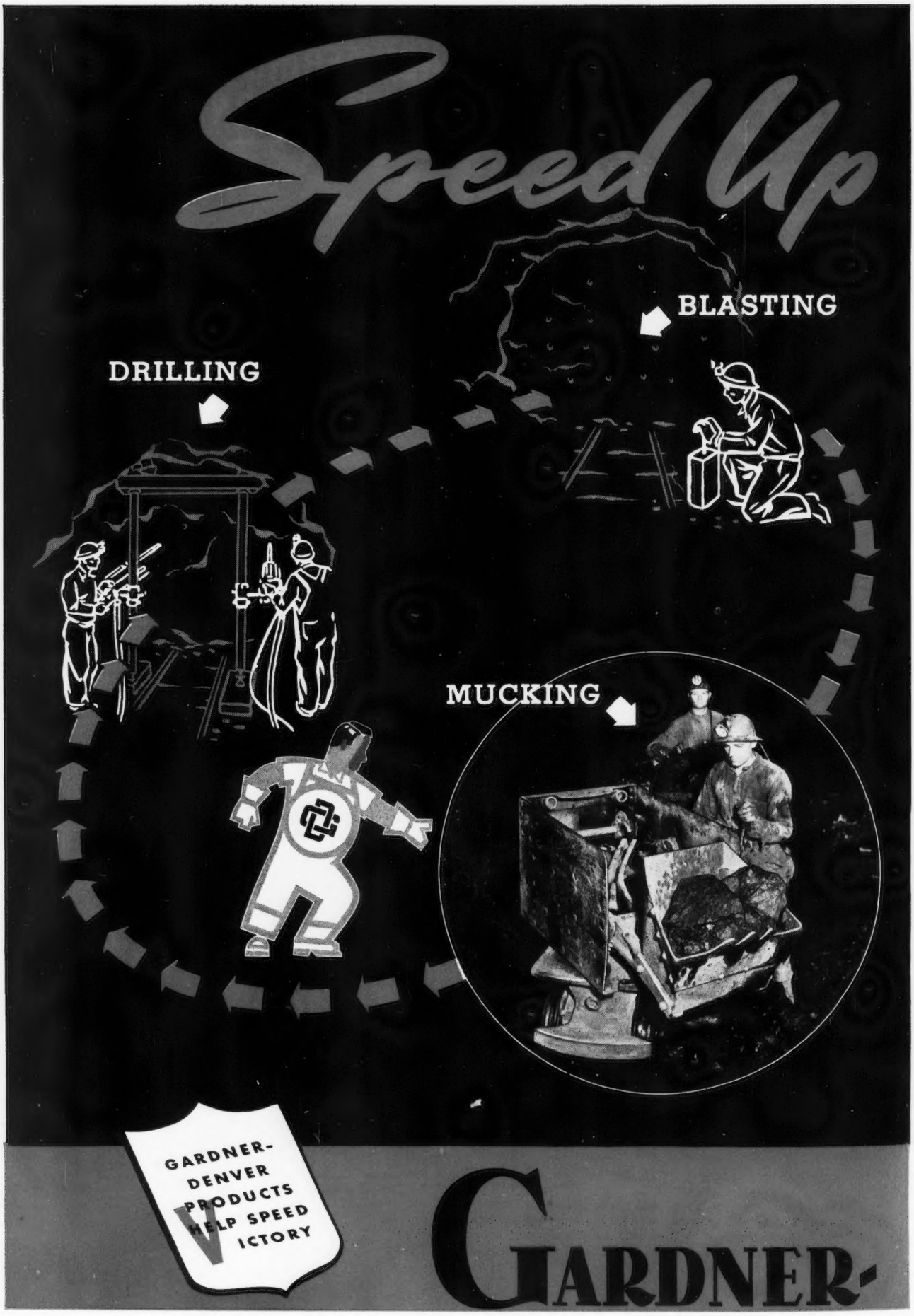
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JUNE, 1942

Volume 143 Number 6

Censorship

THE VALUE of technical information in this war, and of the journals publishing it, is attested by the regulations of the Office of Censorship and of the Office of Export Control of the Board of Economic Warfare. The function of both organizations is to deprive the enemy of knowledge and information that might give him aid and comfort to our own disadvantage. The Censor asks voluntary compliance with a Code, and the BEW controls the foreign mailing of each issue of *E.&M.J.*, for example, by granting or withholding an export license. In addition to the restrictions imposed by these two agencies, the Army and the Navy also reserve the right to permit or prohibit publication of certain matter. All of which lays upon the editor of a technical magazine an obligation to watch his step and to exercise caution in selecting the content of his paper. Fortunately for the mining industry, its methods and processes are internationally known, practiced, and freely publicized. Secrecy, so common in other industries, is almost unknown. So it seems unlikely that censorship will deprive *E.&M.J.* subscribers of much information to which they are reasonably entitled. Nevertheless, we ask readers to be considerate of the editor's problem, and lenient in criticism of seeming delinquencies. Our first duty is to observe regulations imposed on us by the war.

Write Your Congressman

CONGRESS is at present laboring over the most burdensome tax law in the history of the country. Our patriotic duty in the face of the war emergency, and the obvious wisdom of bearing as much of the cost pay-as-you-go, require that we acquiesce to the imposition of a tax load even heavier than can be borne permanently; nevertheless, this is no reason for espousing or submitting to unsound methods of application.

To tax capital to the point of making it fugitive can hardly be defended as constructive public policy. However, this is exactly what the Treasury sought to do in its recent attack on percentage depletion. The overwhelming vote against the Treasury viewpoint in Ways and Means by a committee desperately seeking new revenues shows that convincing evidence was presented that the present percentage allowances are not too high. The mining industry is in fact putting its depletion allowances, and more, back into exploration for new ore reserves.

Today, the mining industry is depleting its irreplaceable capital wastefully and uneconomically to help win the war. When the tax collector comes around, it is only fair that he should recognize that much of the profit shown is due to the accelerated rate of destruction of ore reserves. To throw all such income into the category subject to excess-profit tax computations and virtually confiscatory tax rates is in fact taxing capital to a crippling extent. If we thus squeeze capital out of the mining industry, there can be only one answer: the taxpayer will have to finance exploration for new mineral reserves.

To meet this situation, the amendment sponsored by Senator Johnson, of Colorado, during the consideration of the 1941 Revenue Act, sought to relate net income for mines to "base period net income" on the basis of units of production involved. In other words, it would avoid taxing as excess profits the proceeds from the expanded production needed for war except in so far as unit profits are higher than during the base period. Also, it would provide a needed incentive toward seeking out the minerals so urgently required.

This amendment was introduced into recent Ways and Means Committee proceedings, but, because of insufficient support from the grass roots, failed to gain serious attention. However, there will be other opportunities for

amendment when the tax bill goes to the Senate Finance Committee or when it is under consideration on the floor of either the House or the Senate.

Congress is not likely to show much interest in mere principle unless numerous direct communications from the home folks bespeak an active interest on their part. Not many members of Congress or other public officials understand the special problems of mining, whose principal capital assets are both wasting and irreplaceable. Hence, if mining men, and those whose interests are most intimately concerned, want to see the Johnson amendment passed, they would do well to write or talk to their senators and congressmen without delay, urging support for that measure.

The Cautious Investor

WITH A PRIMITIVE FAITH in the magic of gold, but untroubled by priorities and unaware of the current trials and tribulations of gold miners, a naïve Middle Westerner recently wrote to W. C. Browning, Western representative of Gold Fields American Development Company, in Los Angeles, seeking advice about gold mines. In a scrawling hand that suggested accompanying contortions of tongue in cheek, Mr. Browning's correspondent posed three questions.

"Sirs," he wrote, "give me the following information regarding gold mines:

"1. If one would like to buy one how and what should one do?

"2. How much do they cost?

"3. Are there any to be had around there?"

The amusing aspects of the letter are evident, but maybe the writer wasn't so naïve after all. His questions go directly to the point, and are asked in logical sequence. He doesn't let his enthusiasm run away with his caution. Certainly many a less prudent investor might well have sought a wise answer to the first question before spending his money. "How and what should one do?" In a thoroughgoing answer to that query lies the whole philosophy of mining investment. After that is disposed of, one may explore the market and make inquiry concerning what is offered. Another merit in Mr. Browning's correspondent is that he sought advice from competent authority, something that many wishful investors are inclined to avoid. So frank an inquiry doubtless received an equally straightforward answer.

Salvage and Maintenance

AS THE UNITED STATES' WAR EFFORT approaches its peak in production, the industrial economy is strained to its utmost to provide raw materials and to keep factory wheels turning without loss of time from avoidable breakdowns. Hence the twin vital necessities of the moment—to salvage critical materials that otherwise would be lost or wasted, and to give the best of care to machines that cannot lightly be discarded and replaced in these strenuous times. Salvage and maintenance are the first aids to all-out war production.

Salvage is the joint responsibility of labor and management, and both working together can achieve surprising results. At the Grasselli, N. J., plant of the duPont company, the salvage campaign of the labor-management committee netted in one month 100 tons of scrap iron, 9.5 tons of hard lead, 5.25 tons of copper, 3 tons of brass, 1.75 tons of aluminum, 1.75 tons of stainless steel, 500 pounds of monel metal, and 1,073 pounds of scrap rubber. This record probably cannot be duplicated in its variety at many mining plants, but it's a safe bet that a mine salvage campaign carefully planned and executed would recover tons of scrap iron and steel and substantial quantities of rubber. In some compact mining districts scrap metal could be gathered by the carload.

One of the first things to do in planning a salvage campaign is to list the variety of supplies usually consumed and then arrange for segregated collection of different scrap materials. Stubs of welding rod, broken alloy-steel tools, rubber belting and insulation, dry-cell batteries, drill steel and bits, valves, pipes and fittings, brass and babbitt metals, and a host of other materials can be salvaged for sale to waste-material dealers or recovered for further use.

Of no less importance than salvage is the care of the equipment and machinery we now have. Manufacturers are offering their services in this respect, and should be consulted. Attention to proper lubrication, getting the most service from conveyor and other belting, and care of power-transmission machinery are only a few examples of the importance of maintenance. And here a special word can be injected to urge prompt return of empty compressed-gas cylinders. Oxygen and acetylene are now being used on an unprecedented scale, with hundreds of thousands of cylinders in use. Delay in returning empties means delay in getting gas, for someone else if not for you. Just a little thought to all these matters will be of tremendous help in the war program.

Reflections from Washington

By Special Correspondent

WASHINGTON, which has commonly been indifferent to the problems of the mining industry, now recognizes its vital position in our industrial economy. Shortage of the raw sources of the metals now begins to loom up as one of the major limitations to the war effort. Thus, emphasis is shifting rapidly in the direction of procuring all possible mineral raw materials, with little regard to cost. All methods available to the government of stimulating production will be used, not only from domestic sources but in foreign countries as well.

Gold and Silver Mine Priorities

IN RESPONSE to a protest from a group of Western miners, on May 5, 6, and 8 the Senate Special Committee on Silver held hearings on the subject of the 30 percent clause in Preference Rating Order P-56, as revised March 2. Under the clause, any mines producing more than 30 percent of the value of their output as gold and silver were excluded from the definition of "mining enterprise" and were thus denied the priority benefits granted under the order. Such enterprises would have to fall back on the A-10 rating provided under Order P-100, which is of little practical value, as no scarce articles can be procured with such a low rating.

During the hearings the objections of the complainants and their Congressional friends were substantially appeased when Wilbur Nelson, Administrator of Mine Priorities, announced that Mr. Batt, Director of the Materials Division of WPB, had recommended cancellation of the 30 percent clause. This announcement was coupled with the statement that there would be no change in the manner of administering the order—namely, that serial numbers would be granted to mines on the basis of the importance of their contribution to the war effort.

Inasmuch as the War Production Board has repeatedly stated its conviction that gold and silver mining, per se, is not vital to the war effort in this country, it can hardly be presumed that the announced change will benefit those operations producing only gold and silver. However, mines producing more than 30 percent of the value of their output as gold and silver can now obtain serial numbers, if in the judgment of the Mining Division their production is of sufficient consequence to the war effort to warrant their enjoying the benefits of P-56.

Percentage Depletion

THE MINING INDUSTRY gained a significant victory before the Ways and Means Committee when that important tax-writing body reviewed the Treasury request to reduce existing allowances in calculating percentage depletion. The Committee voted during mid-May by 21 to 4 that the present practice should be continued for metal mines and for oil and gas properties. This was a direct refusal of the request made by Secretary Morgenthau to close what he referred to as "an important loophole."

The Secretary of the Treasury soon after announced that he would again press his request before the Finance Committee of the Senate when the tax bill reaches that body. Meanwhile, the Administration may introduce the issue on the floor of the House after the Ways and Means Committee reports the bill, but in the face of such an overwhelming committee vote the House is not likely to override the decision of its own committee. Nevertheless, if the mining industry would protect the rights under present law that have been established after years of contesting a tax-hungry Treasury before Congress, it would do well to make a strong showing before the Finance Committee. Congress is desperate in its effort to tax all sources of revenue before tapping the pockets of the lowest income groups, and matters of equity may therefore get scant consideration where the need of revenue is so pressing.

Deferment for Miners

WAR INDUSTRY gets definite preference for manpower over the Army. The President, using the War Manpower Commission, took definite steps to serve that objective during May. This probably means that any division of mining which experiences difficulty with local draft boards over skilled workers can appeal for aid with assurance that help will come promptly.

This general policy had to be fixed by Washington at this time to prevent the Army expansion from draining large numbers of skilled workers out of mining and manufacturing enterprise. As steps are taken to raise the Army to a total of nearly four million men by the end of this calendar year, not enough persons are available without either such unwanted action or the taking of men with dependents.

Two further steps in the program of building the Army without slowing down mining may be anticipated. In the first place, the Army is going to get a considerable number of additional young men from the 20-year group who will register at the end of June. Soon thereafter they will probably get many of the 18-year and 19-year classes. This will require Congressional action if the boys are called before their 20th birthday. Apparently, Congress is now approaching the point of willingness to vote that authority, but will probably delay until after elections.

Mexican Dealings

MEXICAN AFFAIRS played two important parts in Washington activities affecting the mining industry during May. Final arrangements were made known at the beginning of the month regarding the purchase by Metals Reserve Co. of additional quantities of copper, lead, and zinc as metal, in ores, and as concentrates. The prices fixed by RFC were intended to stimulate substantially increased output of these needed metals.

According to Mexican sources, Metals Reserve will spend at least $100,000,000 and will purchase at the agreed prices a minimum of 75,000 tons of copper, 250,000 tons of lead, and 200,000 tons of zinc.

The Mexican Government, in response to the generous price, has assured RFC that it will provide a stabilized tax policy, no increase in railroad rates on mineral products, and full cooperation in other ways to facilitate increased mine output. The government and labor leaders of Mexico promise a "cooperative and liberal attitude in the application of the labor laws and regulations applying to certain phases of mining operations."

Far less harmony is in prospect in the proceedings for drafting trade agreements with Mexico and Bolivia. These proceedings involve a possible cut in duty or freezing of tariffs on antimony, lead, molybdenum, quicksilver, tungsten, zinc, fluorspar, and graphite. Briefs on behalf of numerous important companies, and by the American Mining Congress on behalf of the industry as a whole, were filed with officials. An imposing list of appearances was entered personally by outstanding members of Congress from both Senate and House. These appearances were almost unanimous in opposition to any duty reductions.

Several spokesmen agreed that the tariff cuts would be warranted for the duration of the emergency if they tended to support the war program. But it was repeatedly emphasized that import without payment of duty was already possible under the law, and was used extensively by the Navy Department. Furthermore, it was emphasized that duty payment is merely a bookkeeping transaction when the federal government is going to own or use the metal.

Representatives of the mining industry stated flatly that, based upon past experience, the industry has no confidence in the highly publicized escape clauses which are supposed to make the reciprocal trade program flexible. The experience of the zinc industry with the existing Canadian treaty has indicated that the State Department does not invoke these clauses when the contemplated conditions arise.

Great care appeared to be taken by most persons to avoid saying anything that would jeopardize friendly relations with Mexico. The marked importance of

hemisphere solidarity was thus conceded.

It is doubtful whether the State Department will consider favorably the suggestion that the proposed cuts in tariff "for war purposes" will terminate at the end of hostilities. Such a decision would be altogether contrary to the general program of Secretary Hull. The proceeding, therefore, may be regarded as something of a curtain-raiser for the much larger program which will develop later if and when the provisions of the "Atlantic Charter" are presented for Congressional approval.

New BEW Division

THE BOARD OF ECONOMIC WARFARE acted swiftly in May to implement fully its new grant of authority from the President to dictate policy on all United States activities regarding foreign metals and minerals and other strategic materials (*E.&M.J.*, May, 1942, p. 66). A new metals and minerals division was set up in BEW under the direction of Dr. Alan M. Bateman, noted Yale geologist and editor of the *Journal of Economic Geology*, to assume direct supervision over all ramifications of this field.

The new division, in addition to exercising BEW's powers to issue directives to Metals Reserve Co. for purchases of strategics for stockpiling, absorbs also the activities previously instituted by the Coordinator for Inter-American Affairs under Charles Will Wright. Mr. Wright is now a part of the Bateman staff, and his crews of mining engineers on the scene in several South American countries will continue their work much as before, except that top authority now rests with BEW instead of the Rockefeller agency.

Dr. Bateman, who is on leave from his mining geology professor's chair at Yale, came to BEW almost directly from his successful leadership of the United States mission which recently reached an accord with the Mexican government. In his new assignment, Bateman has charge of all United States activities relating to foreign minerals, including examination of deposits, exploration, development of new properties, and arrangement of financial aid where necessary. This is in addition to directing Metals Reserve's purchases for stockpiling.

Production Requirements Plan

TWO FACTIONS of WPB have been arguing as to whether Orders P-56 and P-56a should or should not be abolished and all operations under them be placed under the general all-industry Order No. 90, known as the "Production Requirements Plan." In so far as the applications involve materials for construction of mine machinery, such a change would not be of great importance if made. Recently, manufacturers of such machinery, working under Order 56a, have been using the same form as other manufacturers under Order 90. This form, PD-25A, has gone to a different office of WPB when submitted under Order 56a. That fact has caused much argument and concern on the part of the men in the mining industry. They have feared that a change in orders would result in uninformed handling if their requirements are thrown into the Production Requirements Branch, where all other PD-25A forms are handled.

If Order 56a should be abandoned as an independent one, it is not anticipated that any fundamental change in rulings will follow. It is expected that the Mining Branch would simply issue a directive governing the handling of these forms in the PRP division. Thus, the same principles as now govern would apply to materials for machinery manufacture.

Should Order No. 56, which applies to maintenance and repairs at the mines themselves, be merged with Order No. 90, the result would be very different. One faction of WPB is seeking to have this and all other maintenance and repair orders placed under PRP, and official announcement was actually made several weeks ago that all P orders would be permitted to lapse or be cancelled by July 1. The other faction maintains that mining problems are sufficiently different from those of ordinary industry to incur the probability that they would be mishandled by other than specialized administrators. Argument was continuing vigorously early in June, with no convincing evidence as to the result.

Assessment Work Waived

THOSE WHO HOLD MINING CLAIMS are exempted from normally required assessment work for the two fiscal years from July 1, 1941, to July 1, 1943, under a bill signed by the President May 7. The new law provides that the normal provisions of Section 2324 of the revised statutes of the United States are waived for this period. Thus, the requirement of $100 worth of labor or improvements each year is rescinded.

"Provided, That every claimant of any such mining claim, in order to obtain the benefits of this Act, shall file, or cause to be filed, in the office where the location notice or certificate is recorded, on or before 12 o'clock meridian July 1, 1942, and July 1, 1943, a notice of his desire to hold said mining claim under this Act.

"Provided further, That such suspension of assessment work shall not apply to more than six lode-mining claims held by the same person, nor to more than twelve lode-mining claims held by the same partnership, association or corporation."

Taxes on Small Pocketbooks

TENTATIVE DECISIONS reached by the Ways and Means Committee during April and May have often been misunderstood as final actions regarding the big tax bill now pending. The announcement of such decisions is important, but frequently these decisions may be reversed by the committee, by the House itself, by the Senate committee, or by the Senate. Only when the conference committee of the two Houses presents its final recommendation can one be reasonably sure that certain controversial points are going to carry through into the final law.

Despite this uncertainty, there is apparent a sure trend toward the heavier taxing of many persons of small income. Tentatively, the Ways and Means Committee has announced that it will give exemption from taxation to only $500 for single persons and $1,200 for married couples, with the usual $400 exemption for each additional dependent. There appears no certainty that this set of figures will be retained in the final law. Alternate procedures are a possible general sales tax or somewhat higher exemption figures. If Congress decides to impose a withholding tax on very small incomes, as well as larger ones, that decision may encourage a low exemption figure.

Taxes on corporations will be practically confiscatory of all "excess" income greater than that calculated on either invested capital or average income during the base period. Congress is not quite as willing to take all of the individual income above $25,000 per year as proposed by President Roosevelt. Nevertheless, it will be very difficult for even the most successful business executive to have much more than that left after the visit of the tax collector.

Zinc Allocation

COMPLETE CONTROL of slab zinc was scheduled to start June 1 by W.P.B. Preference Order M-11. Simultaneously issued was a supplemental order placing zinc oxide and zinc dust under the pool arrangement, which has heretofore applied only to slab zinc.

The new control system will be carried out much like the prevailing copper control program. Producers of zinc of any grade may ship only on an allocation certificate. These will be issued monthly about the first of the month after consideration of applications made by users.

News "Fines"

Hoist Rope—Wire rope for mine use is now in Schedule A under Order P-56. This item and other items listed as in uncertain status last month (see *E.&M.J.* May issue, page 75) are being gathered under the quota group subject to A-1-c priority. In some cases this causes individual mines to exceed their earlier quotas. But special application to the mining branch of WPB insures relief for any "worthy case."

Placer Gold Ruling—The Wage-Hour Division of the Department of Labor has reversed its ruling that placer gold mining with power machinery is a seasonal operation both in certain Western states and in Alaska. Now it is officially ruled that this operation is not seasonal in continental United States. Alaskan operations remain in the seasonal classification and are thus the only division which may ignore the ordinary overtime rules.

Peruvian Deal—The trade agreement with Peru signed May 7 settled three items of importance to the mining industry. The Peruvian government agrees to reduce its import duty on mining and metallurgical machinery. The United States lowered its duty on bismuth to 3.75 percent ad valorem. Vanadium ores and concentrates were bound by the United States on the free list. The new treaty did not change the tungsten ore or concentrate tariff, although that had been subject to negotiation.

(*Continued on page* 77)

Metering a Factor in I.M.C.'s Phosphate Operations

Completely electrified, International's mines and plants in Florida pebble field make extensive use of recording units—Some maintenance problems

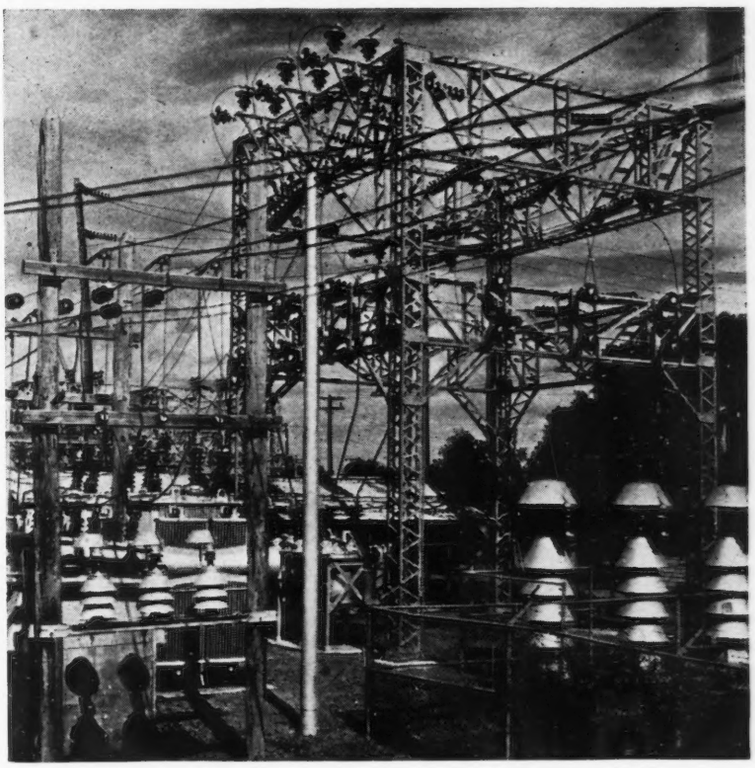
J. H. Edwards
Electrical Editor

ELECTRICAL SUBSTATIONS and equipment for power distribution and metering, motor drive, and control represent a large part of the investment in machinery at the International Minerals & Chemical Corp.'s phosphate mines and plants centering at Mulberry, Fla., in the pebble field. Three hundred electric motors totaling 10,365 connected horsepower and their aggregate loads impose an average 30-min. maximum demand of 6,360 kw. All operations are electrified, including 15 miles of standard-gage railroad. A recent change in practice involving the digging of matrix with electric draglines instead of mining it by hydraulic monitors has reduced power consumption. Recording watt-meter and graphic watt-hour meters are maintained on all the principal loads, and on the records they make the management depends largely for checking performances on machines, crews, and production units.

Through the courtesy of Franklin Farley, general manager of the Phosphate Division, Chicago, and R. B. Fuller, manager of the Florida Phosphate Rock Department, I visited the properties to obtain the facts for this account of the electrical equipment and problems of maintenance. F. B. Bowen, mining superintendent, and H. F. Houghton, chief electrician, assisted in the field survey.

The phosphate matrix, which occurs in a deposit 10 to 15 ft. thick, lies under 18 to 25 ft. of unconsolidated overburden. At each of the two mines of the International the overburden is dug without shooting and is cast aside by a 9-cu.yd. Marion 360 electric dragline mounted on track wheels. The stripped matrix is then dug, also without shooting, and hoisted to a surface sump by a 5 cu.yd. Bucyrus-Erie 175B electric dragline also on track wheels.

At the sump, hydraulic monitors operating at 80-lb. pressure break up the matrix for the pit pump, which, with the aid of relay pumps, moves the material to the washer. By means of the electric haulage system the washed material and concentrates are then transported to a wet storage plant adjacent to a drying and grinding plant situated about three-quarters of a mile from Mulberry.

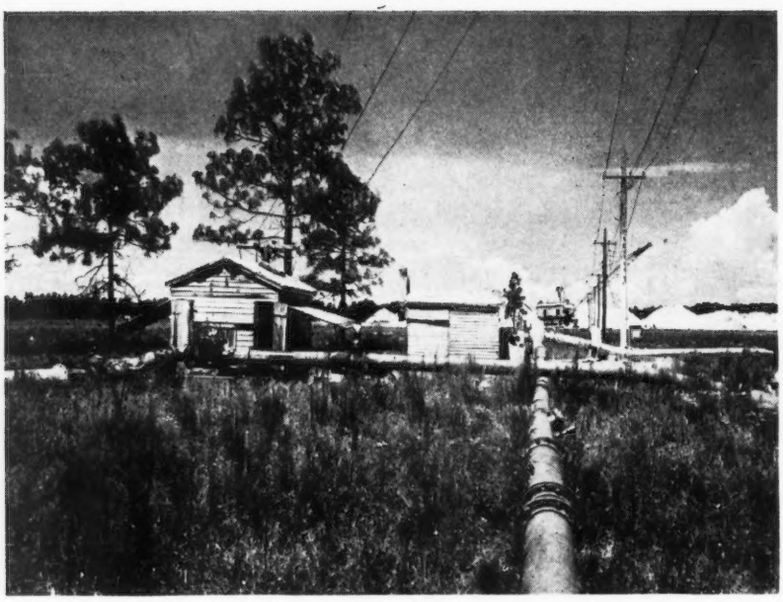


The International owns and maintains this substation, which includes three 2,667-kva. 66,000/11,000-volt transformers

All power is purchased from the Tampa Electric Co. and metered at two substations, designated respectively as the "Diesel Tampa substation" and "Mine No. 122 substation." At the former the International owns and maintains the 66,000/11,000-v. equipment, which includes three Westinghouse Inertaire air-blast oil-cooled 2,667-kva. transformers. At the No. 122 substation the transformers, of a total capacity of 2,500 kva. and reducing from 33,000 to 2,300 v., are owned by the power company. On the 11,000-v. lines from the diesel Tampa substation the International has 29 individual transformers aggregating 8,200 kva. For the small motors in No. 92 washer, No. 2 recovery plant, the laboratory, and the central shop there are twelve 2,300/220-v. transformers, of a total capacity of 1,150 kva.

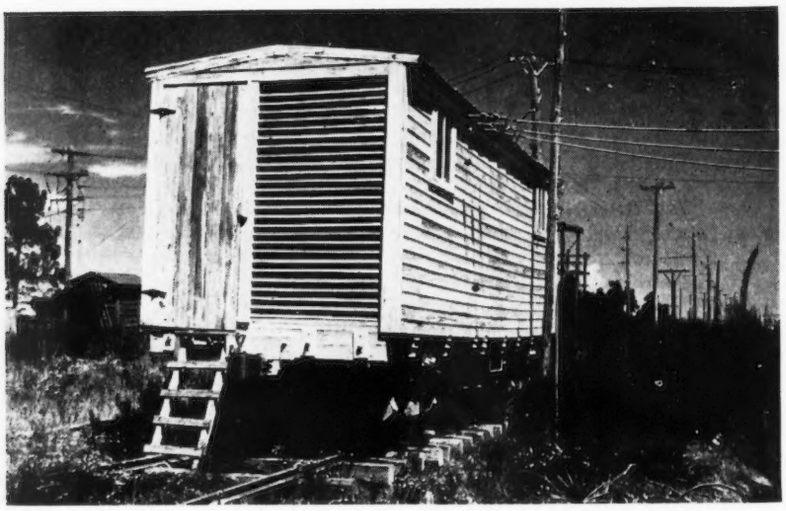
Forty-four General Electric watt-hour meters are in use on the 2,300-v. branch circuits and on large motors. In addition, a number of Esterline-Angus portable graphic watt-meters are in service. One on each dragline circuit serves to check on delays and proper handling. Watt-hour meters are read each day and the results forwarded to the manager's office at Mulberry, where the kilowatt hours per unit of digging and per unit of production are tabulated and studied. The watt-meter charts are examined frequently by the mine superintendent.

All four draglines are G.E. equipped and have Ward Leonard controls, and their synchronous motors operate on 2,300 v. Trailing cables are 1,500 ft. long, which is sufficient for working out a 40-acre tract from one connection



500-hp. hydraulic monitor pump and 300-hp. booster pump at Mine No. 122

This 12-in. matrix pit pump at Mine No. 92 is driven by a G.E. 300-hp. 600-r.p.m. motor having rotor resistance speed control



This boxcar houses a 200-kw. full-automatic 600-volt d.c. substation now parked at the end of the line at Mine No. 122

to the pole line. Three single conductors, size No. 1 with rubber jackets and insulated for 3,000 v., are used instead of a three-conductor cable.

Although it is recognized that the greater spacing of three single conductors results in a higher impedance than for a cable circuit, the advantage of easy splicing and short delay in case of a cable failure is considered important. When cables become worn and more likely to shoot to ground, they are for the most part held off the surface of the ground by a series of short wooden stakes with notched tops.

Secondaries of transformers supplying 2,300 v. to the draglines and other loads of that voltage are delta-connected, and thus no grounded neutral is available to carry in conjunction with the trailing cables and to connect to the frames of the draglines. Chains and rails normally pulled behind the machines serve as grounds to shunt the wooden ties which when dry would insulate the machine from earth. During the past year a ground detector with horn alarm was added to the system. Since introduction of electric strippers in 1924 the International has not had a fatality from electric shock on the draglines nor trailing cables. Rubber gloves with leather covers are kept on each dragline for handling trailing cables.

To the 9-cu.yd. Marion 360 dragline stripper at Mine No. 92 regenerative electric braking of the hoist was added in 1939 to the original control arrangement. This improvement has been successful in speeding digging and reducing maintenance.

Power factor of the total mine load now fluctuates between 80 and 90 percent, which is lower than a year or two ago due to discontinuance of 800-hp. synchronous-motor-driven pumps (200- to 225-lb. pressure), which formerly dug matrix. At each mine one 300-hp. constant-speed induction motor now supplies water at 80-lb. pressure for three hydraulic monitors with 2- to 3-in. nozzles, which break up the matrix after it has been lifted by the 5-cu.yd. dragline. Formerly it was necessary to use electric power to drill holes for ditches in the bottom rock for getting the matrix to the pit pump. Now that the dragline lifts the matrix to the surface, the mining is done entirely without explosives.

Pit pumps and boosters which trans-

Electric Motors and Total Connected-Horsepower

	Number in Use	Connected Horsepower
Mine No. 92	32	2,806
Mine No. 122	17	2,470
Wet storage	34	870
Drying and grinding	86	1,987
Reclamation plants No. 2 and No. 4	106	2,112
Shops and miscellaneous	25	120
Totals	300	10,365

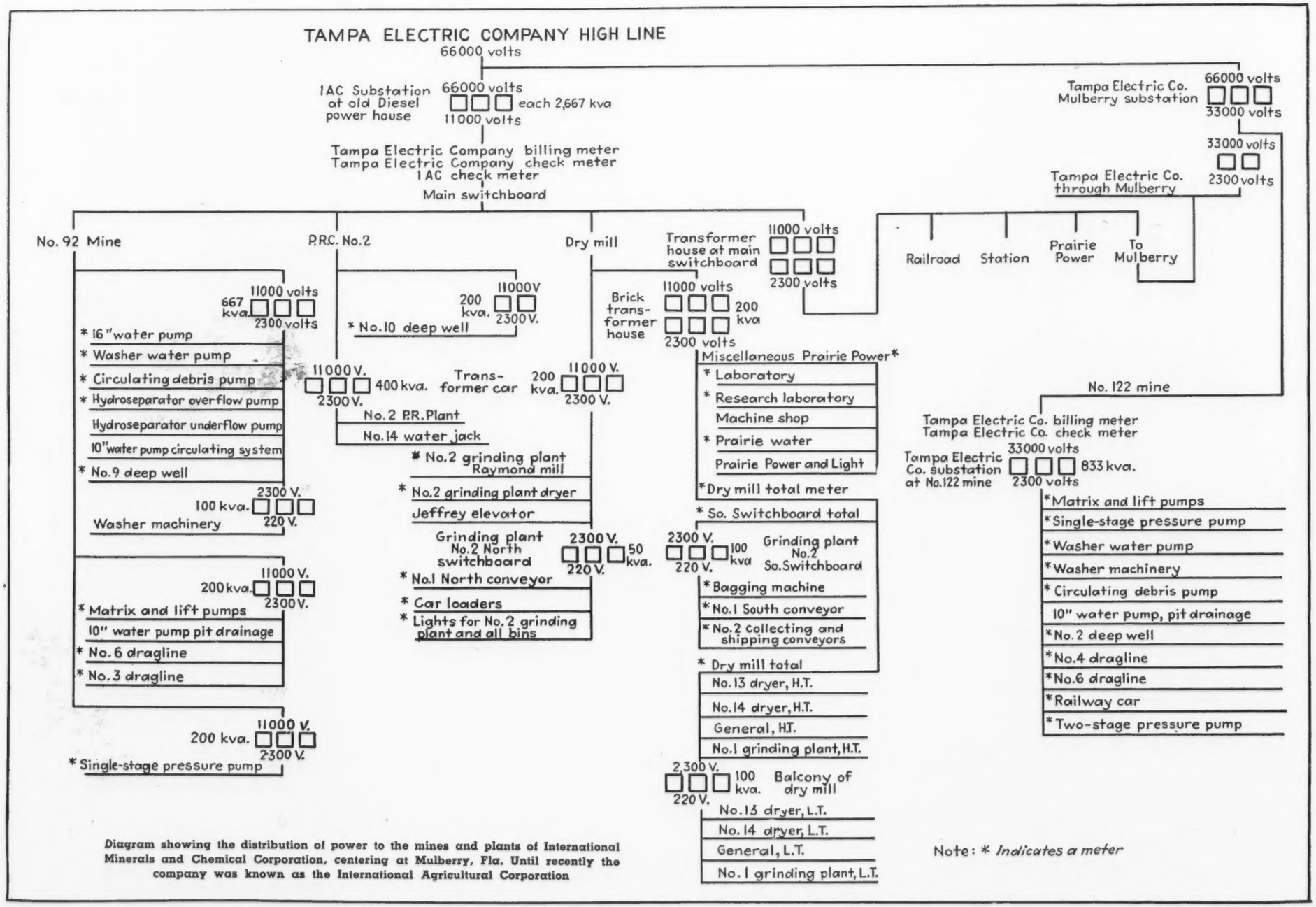


Diagram showing the distribution of power to the mines and plants of International Minerals and Chemical Corporation, centering at Mulberry, Fla. Until recently the company was known as the International Agricultural Corporation

port matrix to the washers are driven by a 300-hp. wound-rotor variable-speed motor with grid resistance control. For the most part these are of 12-in. size and the maximum speed is 600 r.p.m. Four deep-well pumps add to the electrical load. Two of them which supply water for mining and washing are Worthington 3,500-g.p.m. turbine pumps driven by 75-hp. Westinghouse Type CS 2,300-v. motors. The other two wells, both for domestic supply, have 20-hp. and 7½-hp. motors. At the former there is also a 30-hp. motor with full automatic control driving a centrifugal unit pumping to a storage tank.

Six Westinghouse trolley locomotives, two of them 30-ton and the others 20-ton, comprise the motive equipment for the standard-gage haulage. For the trolley system power at 600 v. is generated at two substations, one a two-unit stationary type at the diesel Tampa substation and the other a single unit portable at Mine No. 122, 6 miles by rail from the former. All three units are driven by 2,300-v. synchronous motors. The stationary units are 300-kw. Westinghouse with manual control and the portable is a General Electric 200-kw. with Westinghouse full-automatic control. This substation, mounted in a box car, is started and stopped from a pushbutton station about halfway out on the line.

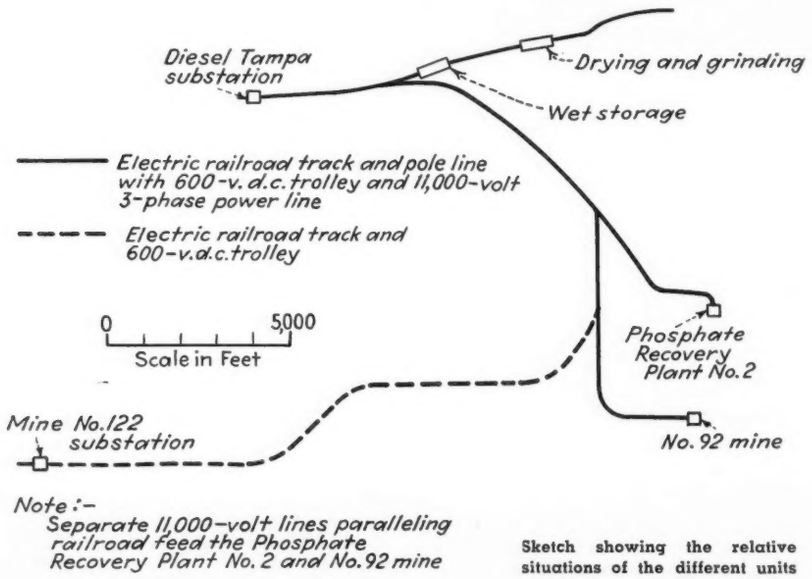
Rails are bonded with Ohio Brass long-type steel-weld bonds. To facilitate the arc welding, which is done through resistance from the 600-v. trolley, the system is run with the trolley wire negative and the rail positive. Although it is recognized that the welding could be done with trolley positive, which is the common practice at coal and metal mines, there is an operating advantage in having the rail positive and thus generating the greatest heat at the work rather than at the electrode. Electrolysis control is not a consideration, as no pipe lines parallel the railroad tracks closely.

On a ramp and trestle where the phosphate rock is dumped to wet storage and where a trolley wire would interfere with operation of a railway clamshell crane, the locomotives are powered from a third rail. Instead of having each locomotive equipped with third-rail shoes, two trailer cars with shoes have been built and are hooked as trailers to those locomotives which work on the trestle.

Original control equipment of stationary motors are being renewed with automatic starters or being converted to automatic or semi-automatic types. For instance, several of the 2,300-v. manual-type K-20 oil-circuit breakers on pit and booster pumps have been converted to pushbutton type by adding a solenoid to each. This provides safer operation and reduces switch contact maintenance.

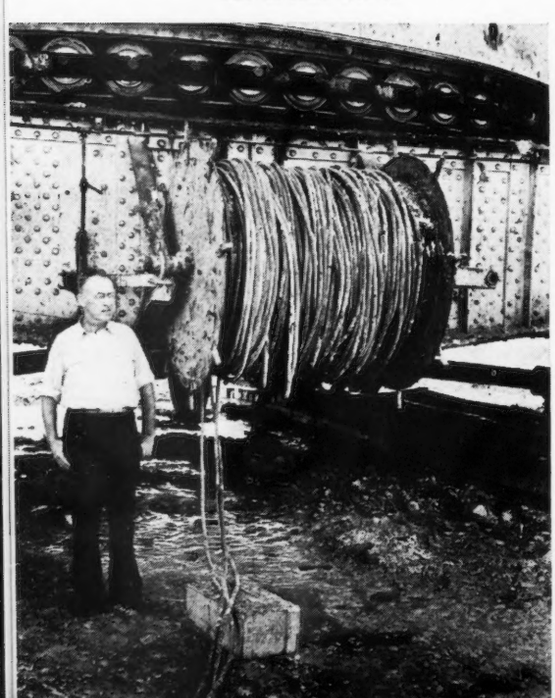
A voltage of 220 is used for small motors, but the total of this load is comparatively small. For the most part these motors are under 20 hp. and are used in driving some of the washer machinery and the conveyors and auxiliaries at the mill. The washer at Mine No. 122 is typical of motor sizes and voltages. Here the washer supply pump is driven by a 100-hp. 2,300-v. motor, the circulating débris pump by a 150-hp. of the same voltage, and the washer machinery by seven motors, of which four (three 50-hp. and one 20-hp.) are 2,300 v. and three (two 7½-hp. and one 5-hp.) are on 220 v.

A new electric load will soon be in operation. It is a concentration plant with 16 tables and 24 flotation machines. The three transformers for supplying that plant are the new Spirakore Type HS made by the General Electric Co. The ratings are 250 kva., 2,400-4,150/220-440 v.

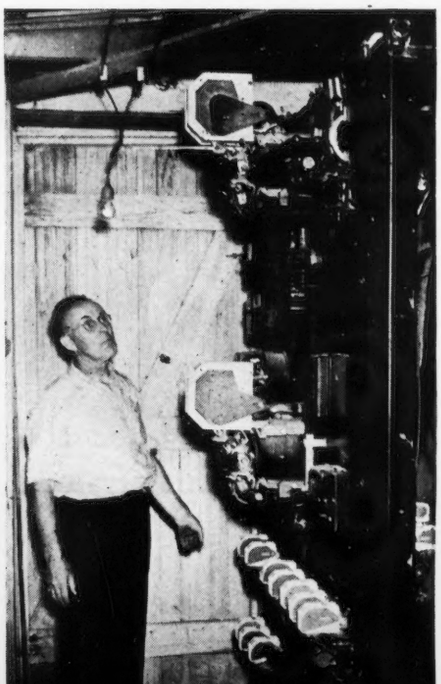

Diesel Tampa substation
Drying and grinding
Wet storage
Electric railroad track and pole line with 600-v. d.c. trolley and 11,000-volt 3-phase power line
Electric railroad track and 600-v. d.c. trolley
0
5000
Scale in Feet
Phosphate Recovery Plant No. 2
Mine No. 122 substation
No. 92 mine
Note:-
Separate 11,000-volt lines paralleling railroad feed the Phosphate Recovery Plant No. 2 and No. 92 mine

Sketch showing the relative situations of the different units

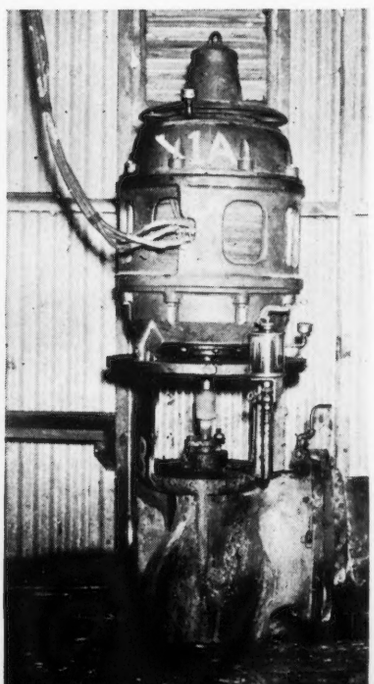
Chief electrician H. F. Houghton stands beside the reel carrying three single-conductor No. 1 cables supplying 2,300 v. to the 9-cu.yd. Marion 360 dragline at Mine No. 92

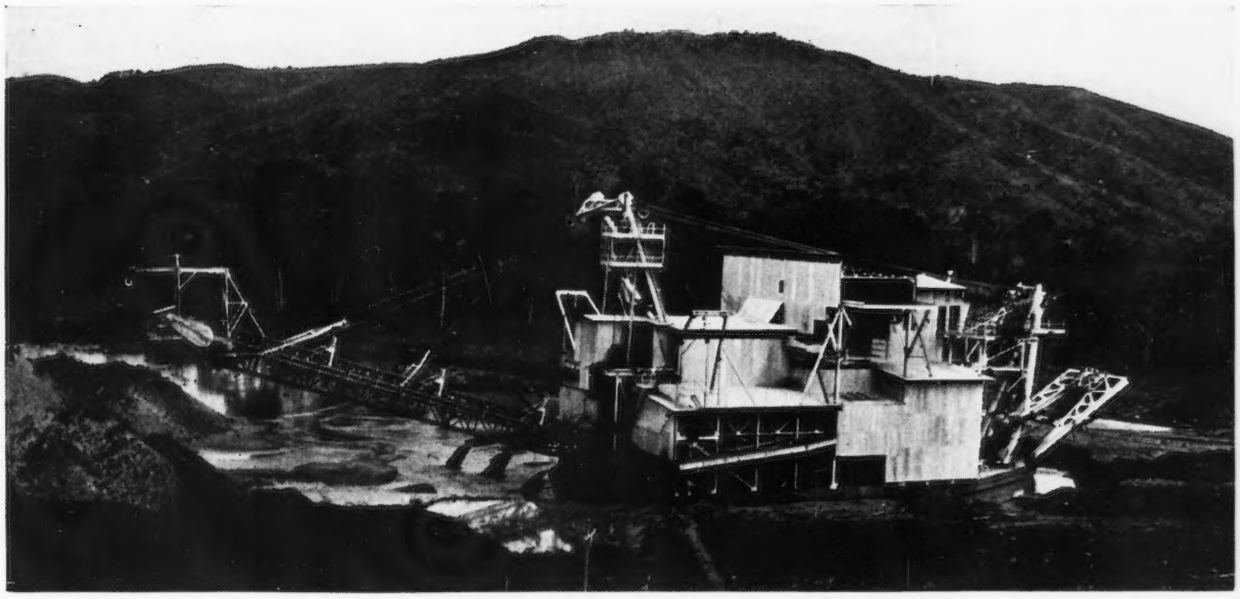


Westinghouse automatic control board of the 200-kw. automatic substation



Westinghouse 75-hp., Type CS, 2,300-v. motor driving Worthington 3,500-g.p.m. deep-well turbine pump engaged in supplying No. 92 mine





The new 12½-cu.ft. gold dredge of Asnazu Gold Dredging Ltd., at San Francisco, Cali, Colombia, has up-to-date operating and control equipment. It began work last November

A Mining Tour of South America

IV—Cerro de Pasco's great mining enterprise—Some gold-mining operations in Ecuador and Colombia—The journey ends.

John B. Huttl
Assistant Editor

ONE OF THE DIFFICULTIES confronting the visitor after arrival in Lima is to fulfill the different requirements demanded by the police, internal revenue, and other government departments. I spent practically an entire day having papers signed and my passports put in order. In the afternoon I managed to see Raymond Spilsbury, general manager, Cerro de Pasco Copper Corp., who made arrangements for me to visit the company's properties in and around Oroya; W. O. Vanderburg, mineral specialist, U. S. Embassy, and Dr. Carlos del Solar, of the Banco Minero, and several of his aides.

Tuesday morning at 7 o'clock I left Lima for Oroya on the F. C. Central, arriving there at about 3:15 p.m. The railroad is one of the engineering wonders of the world, rising to almost 16,000 ft. at Ticlio, over a series of switchbacks, and then slowly descending to Oroya at 12,250-ft. elevation. The scenery is magnificent. Parallel to the rail line runs a well-paved highway, one of the finest I have seen in South America. I planned to return to Lima by car, but, alas, *no podia ser,* because the road was washed out completely at about ten points by recent floods. I presented myself at the main office of Cerro de Pasco Copper Corp., where I met V. L. McCutchan, assistant general manager; W. W. Fowler, general superintendent; and T. E. Harper, chief metallurgist.

Cerro de Pasco is a great mining enterprise, and one of diversified operations. The nerve center is Oroya, where the large smelter is situated. The contributing units are within a radius of about 176 km. These include Cerro de Pasco, 132 km. distant and at an elevation of more than 14,200 ft.; Morococha, 34 km. away and 14,887 ft. high; Casapalca, 68 km. and 13,625 ft.; and Mahr, 24 km. distant and more than 13,000 ft. The company's coal mine, Goyllarisquisga, is 42 km. from Cerro de Pasco. All properties are accessible both by rail and over good highways. Oroya is a typical mining town on the Montaro River. Direct-smelting ores assaying from 4 to 5 percent copper are mined at Cerro de Pasco. Here also are a series of beehive coke ovens producing coke from Goyllarisquisga coal for the lead blast furnaces at Oroya. All copper ore is mined underground, only silica flux for converters being removed by open-pit methods.

The lead-zinc concentrator now under construction at Cerro de Pasco will handle 800 tons of ore a day assaying 7 percent lead, 16 percent zinc, and 5 oz. of silver. Production per day is expected to amount to 80 tons of lead concentrates and 320 tons of zinc concentrates. The concentrator at Mahr is treating about 300 tons of copper-lead-zinc ore brought from the San Cristobal mine via an aërial tram. Treatment includes two-stage crushing in gyratory and cone crushers, grinding to 60 percent minus-200 mesh in a large ball mill in closed circuit with a mechanical classifier, removal of copper-lead concentrates in a 16-cell Weinig flotation machine, and flotation of the tailings in pneumatic machines for production of zinc concentrates. The resultant copper-lead and zinc concentrates are thickened and filtered, the former being sent to the smelter in steel bottom dump cars, and the latter sacked for shipment to the United States.

At the Morococha unit, copper ore mined underground is handled in an 800-ton mill. The chief copper mineral is chalcopyrite, and mill heads assay

about 3.3 percent copper. Mine-run ore is reduced to minus ½-in. in two stages, ground to 50 percent minus 200 mesh in ball mills with mechanical classifiers, and the pulp floated in pneumatic machines. Two concentrates are made—a copper concentrate containing 22 percent copper, and a pyrite concentrate for flux that assays 45 percent iron. Tailings run 0.15 percent copper. Ratio of concentration (copper) is 7:1, and over-all recovery from 96 to 97 percent. Reagents used in the copper circuit include lime, cyanide, Aerofloat, pine oil, and amyl xanthate. Sulphuric acid (to pH6) is added to the pyrite circuit. Finished copper concentrates are thickened and filtered in Oliver filters before being shipped in railroad cars to the smelter; the pyrite concentrates are dewatered in classifiers.

Ore treated at the 400-ton Casapalca concentrator contains the following: Copper, 1.7 percent; lead, 7.6; zinc, 9.5; and silver, 23 oz. per ton. Crushing to 2½ in. is done in a gyratory, followed by reduction to mill feed, or ½ in., in a 4-ft. cone crusher. Grinding to 45 percent minus-200 mesh is done in ball mills with classifiers, with 80 percent of the sands returning and 20 percent being reground in a rod mill with classifier. Overflow goes to flotation. Here, mechanical and pneumatic machines are used. Concentrates produced assay as follows:

Copper concentrates, Cu 27.3 percent; Ag 353 oz. per ton; Pb 6.2 percent; and Zn 11.1 percent.

Lead concentrates, Cu 0.8 percent; Ag 39.6 oz. per ton; Pb 75.0 percent; and Zn 2.8 percent.

Zinc concentrates, Cu 0.5 percent; Ag 2.1 oz. per ton; Pb 1.0 percent; and Zn 59.9 percent.

Tailings, Cu 0.8 percent; Ag 1.3 oz. per ton; Pb 0.9 percent; and Zn 2.2 percent.

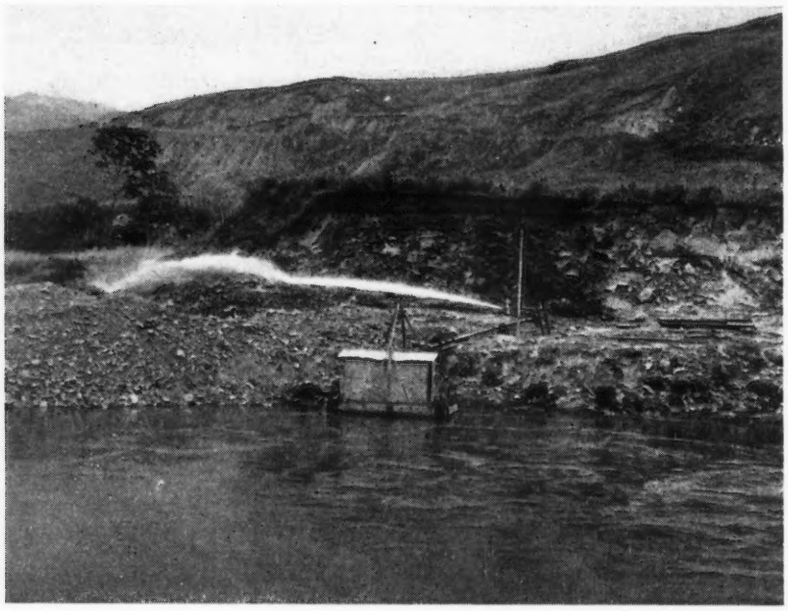
Ratio of concentration in the copper circuit is 21:1; lead, 15:1; and zinc, 9:1. Save for the zinc concentrates which are filtered and sacked for shipment to the United States, all products are filtered and taken in steel cars to the Oroya smelter. Flowsheets of the concentrators described so sketchily are relatively simple and designed to meet local conditions.

The smelter at Oroya also handles custom ores shipped from several active producers, of which Cie. de Mines de Huaron is one of the largest. This company operates copper, lead, and zinc properties in the Cerro de Pasco area. Mills include one 200-ton copper concentrator and two 250-ton plants treating lead-zinc ores. At the smelter all ores received from the corporation's mines and mills are delivered to receiving bins adjacent to the crushing plant after being weighed on standard railroad scales. At the crushing plant the copper ore is crushed to minus-$\frac{7}{8}$ in., sampled, mixed with necessary concentrates and flux, and conveyed to the bedding plant which is equipped with an extensive belt-conveyor system, and Robins-Messiter reclaiming units.

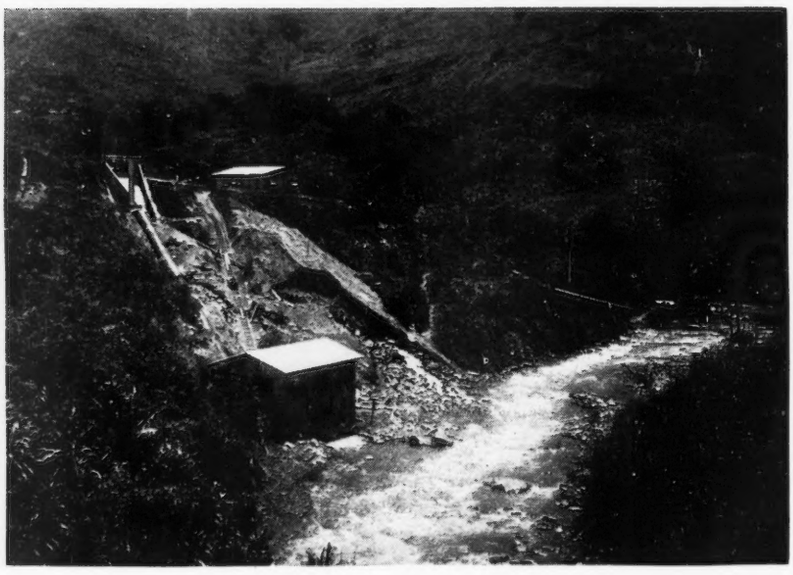
Lead ores are handled in the same manner. In the copper department the usual procedure is to mix on beds of about 8,000 tons, which contain 20 percent insoluble; 29 percent iron; 4 percent lime; 31 percent sulphur; and 6 percent copper. This material is conveyed to the ten 25-ft., seven-hearth roasters now in use, producing calcines with a 17 percent sulphur content, at 750 deg. C., which constitute the feed to two 100x25-ft. reverberatory furnaces. These handle about 800 tons a day each. There are six burners on each, of which two use pulverized washed domestic coal, and the remaining four Bunker C fuel oil. Life of the furnace arches is about two years. Slag assays: silica, 32 percent; Al_2O_3, 3 percent; FeO, 50; CaO, 5; and Cu, 0.35. Reverberatory matte averages 18 percent copper. The converter aisle contains five 20x12-ft. converters and one 30x13-ft. converter. All are of Peirce-Smith design. Copper bullion produced contains 97.5 percent copper, 250 oz. silver, and 2 oz. gold per ton. A revolving holding furnace and a straight-line casting machine using copper molds are used for casting cakes weighing 320 lb. each, which are shipped to Carteret, N. J., for refining.

Prepared lead ores containing 11 percent insoluble, 10 percent iron, 12 per-

Hydraulicking overburden at Asnazu, Colombia, where the Asnazu company operates a 6-cu.ft. dredge



One of two hydro-electric power plants operated by Asnazu Gold Dredging, Ltd. Known as the low-head plant, it produces, 1,400 hp. It is at Ovejas, 7 miles from Asnazu



cent sulphur, 5 percent zinc, 38 percent lead, and 6 percent lime are sent from the bedding plant via belt conveyors to the sintering plant containing ten standard Dwight & Lloyd sintering machines, where the sulphur content is reduced to 2 percent by double sintering. Finished sinter is passed over vibrating screens, the undersize returning to the bed mixture and the oversize going to two 180x48-in. blast furnaces. Fuel used is domestic coke with an ash content of 32 percent, of which about 14 percent, with 1 percent scrap iron, is required for reduction. Lead bullion produced, which after drossing contains 96 percent lead, 100 oz. silver, 2 percent antimony, varying amounts of arsenic and bismuth, and small quantities of copper, is cast into anodes in a circular casting machine. These are sent to the 100-ton Betts electrolytic plant for refining.

All furnaces active in the smelter are in closed circuit with the recently completed Cottrell plant, giving an over-all recovery of more than 96 percent. The reinforced-concrete stack built by the Custodis people is 550 ft. 4 in. high, and handles at present smoke volumes in excess of 1,500,000 c.f.m. The pilot zinc plant placed in operation recently produced about 4 tons of refined zinc a day. Finished electrolytic lead assays 99.995 percent, and zinc 99.98 percent. The carbide plant available produces 100 tons a month of carbide containing more than 26 percent CaC_2. About 34 short tons of 66 Bé. sulphuric acid is produced in a Monsanto Chemical Co. contact plant, employing roaster gases.

Under construction also are a cadmium recovery plant and a ten-oven Curran-Knowles byproduct coke-oven unit. Copper production amounts to 100 tons a day. Power is obtained from three hydro-electric plants at Oroya, Malpaso, and Pachachaca, as well as from waste-heat boilers. R. C. Philpott is superintendent at Cerro de Pasco; N. D. Vogelsang, at Morococha; and C. S. T. Farish, at Casapalca. A A. Wheeler is superintendent of concentration, R. McDonald superintendent of power, A. T. Howard superintendent of railroads; and R. J. Mesney superintendent of the Goyllarisquisga coal mine.

The return trip from Oroya to Lima was made over the F. C. Central de Peru because washouts caused by recent rains made automobile travel impossible. The train was overcrowded. Though the trip was a little *pesado*, I nevertheless enjoyed myself talking and listening to the people. In Lima I again called on Mr. Spilsbury, of Cerro de Pasco; W. O. Vanderburg, foreign mineral specialist, U. S. Embassy; H. Rea Beckwith, consulting engineer; John L. Middleton, consulting engineer; Ricardo W. Kolm, general manager of the Hochschild Company of Peru; Ing. Luis Armas Berendsohn, of the Banco Minero; T. W. Mather, consulting engineer; and Benoni Lockwood and William Crowfoot, who are opening up the Chonta quicksilver mine 55 miles northeast of Cerro de Pasco for Panaminas, a subsidiary of Ventures, Ltd. All had different stories to tell.

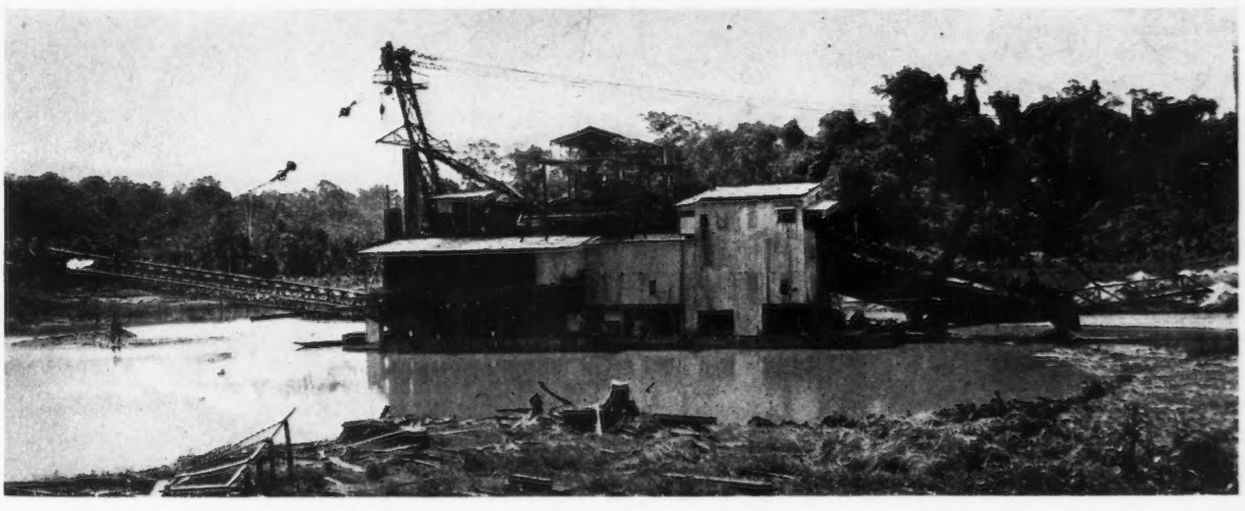
Conditions in Peru differ little from those in other countries visited so far. The country's No. 1 product is cotton, and as cotton goes, so goes the economy of Peru. Reduced exports, several disasters (earthquake in Callao and recent floods), the Ecuadorian incident, etc., have reduced the value of the currency, but not to the same extent as in Chile and Bolivia. Living costs, too, are lower than in the countries mentioned, though prices are rising steadily. This also applies to taxes, and the government agents are watching procedures in the United States and Europe to find new sources of revenue. As to mining, no material expansion is noticeable, though a little foreign capital is coming in, as is the case with Panaminas. The present mining laws seem fairly liberal, especially in the matter of small or medium-size undertakings, but high social-security, unemployment, and a multitude of other taxes automatically cancel some of the inducements offered.

Cerro de Pasco and Northern Peru, subsidiary of A.S.&R., the latter with its 500-ton per day output, constitute the larger part of the mining industry of Peru. All claim that operations and output of metals and minerals would be increased if prices were raised, especially those of copper, lead, and zinc. There is much interest in tungsten, quicksilver, and antimony mines.

As is done elsewhere, Peru levies an import tax on mining and milling machinery. It is not quite as heavy as in Chile, but high enough to encourage home manufacture of such equipment. Difficulties with priorities are driving larger companies to building their own machinery, and the smaller operators are turning to local machine works to fill their requirements. There is also talk about construction of a steel plant, which is to utilize high-grade iron ore south of Lima and coal found in northern Peru. The coal is said to be of coking quality, but a more acceptable product is to be produced by adding waste sludge from the Talara refinery. The plans are still in the blueprint stage, awaiting the necessary cash.

On Monday, Feb. 16, at 6:30 a.m. I left Lima for Ecuador, arriving in Guayaquil at 12:05 p.m. The most interesting thing witnessed during the flight was the sudden change from desert to jungle at Tumbes, near the border of Ecuador. It is unquestionably one of the most interesting natural phenomena to be seen on the entire American Continent, and is caused by the much talked about Humboldt Current. Guayaquil, where I remained for about 8 hours, was as hot as a boiler room. The rains make matters still worse, and it is difficult to get to interior points. Accordingly, I left for Quito by plane. The city, though only a few miles below the equator, has a

Nechi dredge shortly after leaving reconstruction site



delightful climate, principally because of its high elevation, which is more than 9,000 ft. Without major industries, life is quiet there and modest. There are some magnificent colonial monuments and buildings, but that is all. The people are very friendly.

Mining plays but a minor part in the economy of the country, which is agricultural, and is confined to the operations of South American Development Co. at Portovelo, where a 500-ton mill is treating a complex gold ore; at Macuchi, where the company's subsidiary, Cotopaxi Exploration Co., in which American Metal has some interest, is exploiting a gold-silver-copper deposit, the mine output exceeding 150 tons, which is milled in a modern flotation plant; and at Minas Nuevas, where Calera Exploration Co., also a subsidiary of South American Development, is doing exploration work.

At the Department of Agriculture, I called on Ing. Enrique Coloma Silva, Director General of Mining and Petroleum, who is a friendly and capable gentleman. He was enthusiastic about mining in Ecuador, especially as the incident between Ecuador and Peru has been settled satisfactorily at Rio. At the office of South American Development Co., I met Sr. Rivas, general agent.

While in Quito I spent much time with members of the geological division of the Department of Mining and Petroleum. Those met included H. W. Van de Putte, geologist and mineralogist, formerly with the Shell Company in Venezuela and Ecuador; Eduardo Reyes N., statistician, and Herman Moscoso Cardenas, in charge of maps.

Data, maps, and samples were shown me, which indicate a considerable wealth of undeveloped copper, lead, zinc, and silver deposits. There is a wide mineralized belt running north-south, starting at Zamora in the south and extending into Colombia in the north. Portovelo, Calera, and Macuchi are the only points under development and exploitation, and all are worked by South American Development. The country itself lacks the means to develop mineral resources. The total note circulation of Ecuador is $10,000,000 U. S., which barely takes care of ordinary expenditures of running the government and business. Ecuador's outstanding needs are money, roads, and technicians.

While in Cali, Colombia, I visited the operations of Asnazu Gold Dredging, Ltd., at San Francisco and Asnazu in the company of E. P. Roskruge, field manager. Both sites are along the Cauca River and consist of government concessions. The stations mentioned are on the F. C. del Pacifico running from Cali to Popayan. Distances from Cali are 51 and 60 km. respectively. At San Francisco a new 12½-cu.ft. dredge is in operation, and at Asnazu a 6-ft. unit. The former was designed by company engineers and contains the most modern operating and control equipment I have seen. The Asnazu dredge is of older design and was made by Yuba. Digging depth averages from 25 to 30 ft. throughout the two areas. The Asnazu field is much richer than the San Francisco, but difficult to work because of large boulders. Monthly yardage dredged is correspondingly low at times. Asnazu ground yields up to 45¢ per yard, but the San Francisco values seldom exceed 25¢. This balances the loss of output at Asnazu. The new dredge is capable of handling more than 350,000 cu.yd. per month, and the smaller unit 150,000 cu.yd. The company also maintains excellent camps with modern housing facilities for employees and workmen, hospitals, clubs, repair shops, and office buildings. Power is furnished by two hydroelectric plants, one at Asnazu, a high-head plant developing 500 hp., and the other at Ovejas, 7 km. from Asnazu, equipped to produce 1,400 hp. Ovejas power is brought to the camps at 11,500 v. At Asnazu I also met Major Franklin, general manager, and Mr. Brannan, both on an inspection tour of company properties in Colombia from San Francisco.

On Monday morning I flew via Avianca to Medellin, arriving there a little after 12 p.m. Here I called on Everard Leland, general manager of Timmins Ochali Mining Co., Ltd.; Dr. Roberto Luis Restrepo, mining engineer; Dr. Santiago Londono, mining engineer; and Alberto Echeverri Villa, secretary, Asociacion Colombiana de Mineros. As an article describing the Timmins operations near Yarumal by Forbes Wilson and B. F. Darnell was published in *E.&M.J.* in April and May, 1942, I shall not give details beyond the fact that 12-g. ore is treated at the present time in a 300-ton cyanide plant, the monthly ore output running between 10,000 and 11,000 tons. The property is about 198 km. by road and trail from Medellin. Mr. Leland and associates are operating a gold property at Tuquerres, Narino, the 600-ton monthly output being crushed by 20 stamps and the pulp cyanided. A modern 50-ton plant is under construction. One of the largest gold producers in Colombia in respect to output is Frontino Gold Mines, Ltd., at Segovia. High-grade ore is worked here. Choco Pacific Mining is dredging at Barbacoas and Narino; and Pato Consolidated Gold Dredging, Ltd., Thorp Sawyer, field manager, is working five dredges and several small hydraulic gold operations in the Pato placer areas.

Pato Consolidated's operations are in the Pato placer district, a little more than an hour's flight from Medellin. Five dredges are active. Of considerable interest, also, are the hydraulic workings near Zaragoza, on the Nechi River, directed by William A. Newman. Elevation is about 300 ft., so the climate is tropical. Temperatures vary from 92 deg. F. maximum to about 74 deg. F. minimum, with high humidity. Precipitation is about 200 in. per year.

The gravels mined hydraulically occur in relatively small areas at elevations from 25 to 125 ft. above the Nechi River in scattered localities. They are easily worked, as there are no large boulders, and the bedrock generally is soft and decomposed. At times, the gravel contains cement and clay. No lava capping is found. The dense jungle is cleared with Caterpillar tractors, and the uprooted material burned. The cost is about $400 per acre, or 1.35c. per cubic yard. Depth of the gravels varies from a few feet to 30 ft., averaging 15½ ft., which requires frequent moving of plant equipment, apart from obtaining a somewhat low duty per miner's inch. As a consequence, the units used in treating the hydraulicked gravels are specially designed for mobility and portability. For instance, all sluices are

Dredge No. 5, Boyaca, starting to dig into Boyaca mine

made in 8-ft. sections, each of which can be carried by four men. Low water cost is the principal factor responsible for the success of the Pato hydraulic operations. It is pumped at a cost of about 3.68c. U. S. per cubic yard hydraulicked, electric power for the pumps being generated by a large hydroelectric plant. This plan also furnishes power for the five active dredges.

Power cost at the hydraulic operations is 4 mills per kilowatt-hour, the same charge as for the dredges. Pumping equipment is of Worthington make. The five hydraulic workings are served by 12-in. centrifugal LA4 pumps direct-connected to synchronous motors and mounted on steel barges. Each unit has a normal full-load rating of 4,000 g.p.m. against 200 ft. head. For high-head operations the pumps are coupled in series, and in parallel for low heads. Connection with the 16-in. shore pipe lines is made by sections of high-pressure rubber hose. The main 16-in. pipe lines are laid in 30-ft. sections, each weighing 570 lb., and are of spiral, lap-welded steel construction with Taylor or Dresser bolted couplings. Subsidiary pipe lines, of similar construction, measure 10 in. and 12 in. in diameter. The hydraulic giants are of Hendy manufacture (No. 2), with 3-, 3½-, and 4-in. nozzles. The sluices are made in 8-ft. lengths from No. 8 plate, 0.1685 in. thick, bent to shape and welded. Inside width is 36 in. and depth 20 in. They contain no reinforcing units whatsoever. The riffles are made from steel angles 3x3x$\frac{5}{8}$ in. Their length is 35 in. and the spacing 2¼ in., or on 5$\frac{7}{8}$ in. centers, and set on a slope of 1$\frac{5}{8}$ in. to the foot. The sluices are 200 to 500 ft. long, on a grade of 3½ to 4 in. per 8 ft. of length, depending on the proportion of coarser gravel and boulders. All are protected against robbery by screens.

Most workings employ undercurrents. Gravel passes over a bar or a plate grizzly in the bottom of the sluice, the oversize continuing down the sluices, and the fines going over wide, shallow undercurrent sluices on a grade of $\frac{3}{4}$ in. per foot, fitted with cocoa matting. The average life of each hydraulic working is about one year, though some of the smaller deposits are worked out after but a few months, during which giants, pipes, and sluices have been moved several times. Gravel depths varying from 6 to 30 ft. are worked, with 100- to 200-ft. heads on the giants, depending on the gravel. The highest gold values are found in the shallower deposits, some of which were worked by the Spaniards several hundred years ago. The gold is well distributed through the vertical section of the gravel, which is richer on or near bedrock. It is fairly fine and amalgamates well. In fact, a great deal of the gold on the high benches is so fine that it was necessary to install undercurrent tables to make anywhere near an acceptable recovery. Before this was discovered in 1939, a body of high-grade tailings was created, which subsequently was re-worked at a fair profit with a dragline.

From 1938 to 1941 more than 3,200,000 cu.yd. have been pump-hydraulicked, with a respective annual yield of 25.6, 22.7, 35.6, and 47.3c. U. S. Estimated recovery has been about 85 percent. Average cost, including payment of government royalty of 5¾ percent of gross, was 21c. per cubic yard. Power cost for pumping was 3.68c., and direct expense for hydraulicking amounted to 15.17c. Total pumping cost was 4.48c. Labor is paid about 90c. per 8-hr. shift, with skilled men earning as high as $1.50 per shift. About 160 men are employed in hydraulic operations. The total number of men employed by the company in the different units, dredges, shops, drilling, etc., ranges from 1,250 to 1,300. For prospecting possible ground for hydraulicking, Ward drills are used in areas covered with vegetation. Where gravel sections are exposed the ground is cut-sampled. The drill is hand-operated, and employs a 4½-in. casing. Drilling cost is about $1.50 per foot.

The hydroelectric plant layout has no reservoir and no distributing reservoirs or canals common to other similar mining operations. The water conduit is 10,630 ft. long, containing one 9,200-ft. tunnel and a 1,450-ft. penstock. The plant head is 750 ft. At present 5,000 additional kilowatts are being installed (5,000 kw. operating) at the powerhouse. Current produced is transmitted at 35,000 v., and distributed at 6,900 v. A 650-hp. diesel engine is available as a standby. As to gravel reserves (for hydraulicking only), there are about 5,500,000 cu.yd. with an average gold content of 31c. and perhaps another 90,000,000 cu.yd. with a possible content of 25c. The largest deposit worked by pump-hydraulicking methods so far contained 300,000 cu.yd.

The company has done an excellent job in the matter of improving the health of the native workmen. Malaria and other tropical diseases have been materially reduced by proper sanitary precautions and mosquito control, and the best possible treatment is given the sick at the modern hospital maintained by the company at Pato. The same applies to housing facilities. Thorp D. Sawyer is an excellent manager.

Many small gold properties are active throughout Antioquia and other gold-producing districts. Colombia is poor in base metals. Gold is the chief metal produced, and when normal conditions return to the world, additional opportunities in opening up high-grade lode mines and low-grade placers will present themselves. Current gold production, as mentioned before, is obtained from lode, dredging, and hydraulic operations. Lack of space forbids mentioning them all individually. As to large-scale mining operations, there seems to be an absence of large veins that carry enough gold to warrant the effort. There are some lead and zinc deposits in the country, but the veins are narrow, and the holdings too far from transportation. All those interviewed said that the Colombian Government is fair in its dealings relating to mining, taxes are not too high, and that companies can always get a fair hearing in matters relating to labor. The only tax they complained about as unjust is the one levied on funds exported from the country. The Colombians themselves are realistic and devote their efforts strictly to business.

On Saturday, Feb. 28, I left for Balboa, C. Z., to catch the plane leaving for Miami, Fla., the following day. And so I arrived in New York a few days later. Upon my return in San Francisco I had traveled by plane, train, car, horse, or mule a total of 24,047 miles.

Hydraulicking in the Nechi River area, Colombia

Truck Haulage in Mesabi Open-Pit Practice

A survey of the situation as the 1942 season opened

R. W. Whitney
General Superintendent
Butler Brothers, Cooley, Minn.

An electric shovel loading 15-ton trucks in an open pit on the Mesabi. In the right background is the conveyor

THE FIRST large haulage trucks were introduced on the Mesabi range about five years ago, so we can say that practically no tonnage of ore was handled by such equipment until 1938. It is contemplated that during the 1942 ore season at least 31,000,000 tons of iron ore will be brought out of the pits by these large haulage units, the number of which has been conservatively set at 300. Tonnage to be handled by trucks during 1942 will be about 40 percent of the shipments from the Lake Superior District, or approximately half of the total from Minnesota. In addition, these units will move 50,000,000 cu.yd. of stripping material which includes surface overburden, taconite, paint rock, and lean ore. This, added to the 31,000,000 tons, or 15,000,000 cu.yd. of ore material, would make a total yardage of 65,000,000 for 1942. Of the several mines reopened and the new ones developed by the small and large companies during the past 18 months, all have been equipped for truck haulage; therefore, the trend is definitely away from locomotive haulage to truck haulage, or to a combination of truck and conveyor transportation.

I do not believe that it is necessary to go into the reason for this trend, as nearly all of us have been or are operating trucks of one kind or other. Also, the background has been ably covered during the past two years by Grover J. Holt, P. S. Gray, L. C. Moore, and H. E. Reese, as well as by some of the representatives of the companies who manufacture and sell either trucks or engines. I believe that we are all convinced that we can make better costs and be much more efficient by using truck transportation or a combination of trucks with other supplementary units. I will not discuss costs at any length, therefore, but will deal with the various details of truck operation and the different types of equipment. We are not all in agreement, and rightfully so, as to the advantages and disadvantages of the various types of machines.

Each mine or operation has its individual problems, and, in consequence, the equipment has to be adapted to the particular situation which presents itself. We have in use on the Mesabi range four different major body designs: First, the 10-cu.yd. 15-ton rear-dump trucks; second, the 16- to 20-cu.yd. 25- to 35-ton bottom-dump trucks; third, the 6-cu.yd. 9- to 10-ton Dumptor trucks; and fourth, we have the small conventional rear-dump trucks, which, for the purpose of this discussion, will not be considered.

Rear-dump Trucks—Most of the trucks in operation on the range at present are of the rear-dump type. Though their respective body designs vary somewhat, they are of the scoop-end type and all must turn and back up to the dumping point to discharge their load. Experience shows that it takes about 0.5 minutes to turn, stop, and back up, with another 0.3 minute for dumping, making the total lost time for this operation 0.8 minute. (We have estimated that over a six-month period, a truck will back up about 700 miles). Large rocks or frost chunks that will go through the dipper of a 4- or 5-cu.yd. shovel can be handled in these rear-dump trucks without difficulty. The turning radius of these machines is 30 ft., so that they can be easily maneuvered in restricted areas. With this short turning radius, moreover, there is a minimum of backing and turning while getting into loading position at the shovel. Speed of these trucks, most of which are powered by either the Cummins supercharged engine or the Waukesha-Hesselman oil or butane engines, is 9 to 11 miles an hour on an 8 percent grade when fully loaded; the speed when empty will approach 30 miles an hour. These trucks can be loaded with a shovel of any size up to 5 cu.yd.; the larger the dipper, the less time a truck has to wait to be loaded and the more material will be handled in a given time. This means lower costs per unit of material moved.

Though rear-dump trucks haul a smaller load than do the bottom-dump trucks, which will be discussed later, they have the following advantages:

1. Greater speed on heavy grades.
2. They are more easily maneuvered in restricted areas.
3. Ability to handle all kinds of material.
4. Ability to discharge their load over the edge of a waste dump.
5. Lesser initial investment per unit.

These tend to offset the disadvantage of having to back up to unload.

The tire cost for these rear-dump trucks is less per hour than for the bottom-dump trucks, but it appears that the tire cost per unit of material hauled is substantially the same; however, in the case where the bottom-dump trucks use 21x32-in. or larger size tires, the tire cost of the rear-dump trucks would be substantially less, especially if heavy grades were being negotiated.

Bottom-dump — The bottom-dump trucks in use on the Mesabi have an 18-cu.yd. body which carries 28 to 35 tons of pay load. They are of the semi-trailer type and require 34 ft. as a turning radius; however, while making so short a turn, it is sometimes

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necessary to back the unit into the loading position, because the trailer does not require as large a turning radius as the tractor itself. These units discharge their load without stopping, either by dropping the doors or by sliding the doors up along the body. In the former case, the doors are controlled by cables, and in the latter, hydraulically. Although the opening in these bottom-dump trucks is $4\frac{1}{2}$x8 ft., large rocks or frost pieces tend to give trouble, so it is necessary either to set these large pieces aside for further blasting or to have a rear-dump truck on the line into which they can be loaded.

Maintaining a dump for the bottom-dump trucks requires the use of a bulldozer 100 percent of the time, as all the dirt must be pushed over the edge. In the case of the rear-dump trucks, nearly all of the dirt is discharged over the edge of the dump, so that a bulldozer is required only about 20 percent of the time. One bulldozer is needed on the dump and one at the shovel for clean-up work while using bottom-dump trucks, but in the use of rear-dump trucks, one bulldozer will take care of both dump and shovel.

If the material handled is to be dumped into a pocket, the advantages of the bottom-dump trucks can readily be seen, for they do not have to stop to discharge their load; or, if they do stop, it takes only a fraction of a minute for the load to be discharged. If powered by a 200-hp. engine, they will travel 5 to 7 miles an hour under load on an 8 percent grade, and have a top speed of 25 miles an hour when empty. Tire life appears to be about the same on these units as on the smaller rear-dump units. The fuel consumption is about the same per hour, namely 3 gal.

Cost of maintenance of the dumping mechanism should be less because there is no hoist, and, in some cases, no oil pump to be maintained. The purchase price is about 50 percent more than that of a rear-dump truck, however.

Advantages of using the bottom-dump type of truck are:

1. Less time consumed for dumping.
2. No time consumed in backing up.
3. Lower cost of labor and fuel per unit of material handled due to the bigger loads hauled.
4. Less maintenance on hoists and pumps.

These advantages are offset in part by a higher depreciation figure.

Dumptor—The Dumptors, in most cases, are used as shuttle units on short hauls, or as haulage units from the smaller shovels, having a capacity of, say, up to $2\frac{1}{2}$ cu.yd. They are equipped with a 6-cu.yd. box which will hold 10 tons of ore. These machines use the General Motors two-cycle 107-hp. engine for power and will make 7 miles an hour on an 8 percent grade. Although they can be driven at the same speed in either direction and lose no time through having to turn around to discharge or pick up their load, the driver, nevertheless, is required to look over his shoulder at least half of the time, causing him some fatigue. I understand that some operators make it a point to have their trucks head up the grade with the load behind them, as the machine is much easier to control while pulling the load in this manner; also, it gives the driver much better vision.

Some mine operators who are looking for large production think that the economical limit of haul for these machines is 1,000 to 1,500 ft., and this distance on a grade that is not too stiff. However, these trucks are ideal for tight quarters, as their turning radius is 17 ft.; for clean-up work where smaller shovels are used; or in the smaller pits where production is not too great. They have no dumping mechanism but use a gravity dump which depends on the distribution of the load for discharging the material, so that the cost of maintaining hydraulic pumps and hoists is eliminated.

Comparison of the haulage costs given by this unit with those obtained with the rear-dump and bottom-dump trucks previously discussed is difficult because of the many varying conditions involved relative to loading time, length of haul, and the amount of material carried. The initial cost of these machines is 75 percent of the purchase price of the rear-dump trucks.

Let us now discuss briefly the types of engines used in these haulage units:

The Engine Used

Waukesha-Hesselman — (A) The Hesselman oil engine, rated at 200 hp., 1,700 r.p.m., is used in a number of the rear-dump trucks. It uses spark plugs for ignition and consumes $5\frac{1}{2}$ gal. of fuel oil per hour. Oil changes in the crank case are made every 80 hours. Experience has shown that these engines will run 4,500 hours before they need to be overhauled. Although this is a six-cylinder engine, three of the cylinders are cut out on the return trip as well as while the engine is idling. (B) One truck unit on the range was converted to a butane-burning engine during 1940. This proved successful, and early in 1941 six trucks were converted to use butane as a fuel during the 1941 season. Fuel consumption on these engines has been 5.7 gal. per hour, with an increased power output of 15 to 20 percent over that of the oil-burning engines. Butane being a much cleaner-burning fuel than oil, the periods of changing the crankcase oil were increased from 80 hours on the oil-burning engines to 700 on the butane engines. Although the cost of fuel for the butane-burning engines is 20 percent greater than that of the fuel for oil-burning engines, the saving in engine maintenance more than offsets this slight disadvantage. From a test made the past summer on these two types of engines, it was estimated that the cost of maintaining the butane engine will be only 25 percent of that for maintaining an oil engine. It is not known at this time whether this means that the butane engines will run four times as long between overhauls.

During this war emergency, I understand that it is not possible to make conversions from oil-burning engines to butane-burning engines. This is due to the fact that butane is being used in our war effort and the Government is trying to control its use. However, it may be that units going into a new operation can be obtained.

Cummins and Hercules—The Cummins diesel engine, which is rated at 150 hp., or 200 hp. if supercharged, uses 3 gal. of fuel oil per hour. Oil in the crankcase is changed every 70 hours, but if additional filters are used, the interval between oil changes can be increased to 250 hours. Oil is added to the crankcase between changes—the longer the engine has been in operation, the more oil it will consume due to the wear on the oil rings and cylinder sleeves. This is true of all the engines discussed. Experience shows that these engines require to be overhauled after approximately 4,300 hours. The Cummins diesel engines are used in all makes of trucks now in operation on the range, excepting the Dumptor.

The Hercules diesel is a 200-hp. engine which is governed at 1,600 r.p.m. It burns 3 gal. of fuel oil per hour and, like the Cummins, requires a change of oil every 70 hours. These engines are being used on the bottom-dump trucks, but not enough experience has been gained as yet to say how many hours they will work before requiring an overhaul job.

General Motors — This company's 2-cycle engine, rated at 107 hp. when governed at 1,800 r.p.m., uses 2 gal. of fuel per hour. Oil is changed every 70 hours. This diesel motor is one of the newer ones in the field, and the experience gained to date would indicate that it requires overhauling every 4,000 hours. It is too small to use in the larger units, so its use has been confined to the Dumptors in the trucking field. Some of the operators have been investigating whether General Motors make a large enough engine to replace either the Cummins or the Waukesha-Hesselman in the larger trucks, but to date nothing has been found.

Tires—The tire and rubber situation is very critical, as is evidenced by the fact that all tires, as well as retreading and recapping material, are now under the control of the local tire rationing boards, which means that we must go through these boards before we can get new tires or material for repairing them. We hope, however, that this situation will change soon so that mine

operators will be able to get tires and repair material on priorities. Having in mind that the rubber situation is tight, we will have to consider taking better care of our tires, doing more repair work, retreading and possibly some recapping, the latter already being done by some companies. We must therefore take into account the conditions that will lengthen tire life; that is, elimination of overload, care of roads, and maintenance of tires. We must become more conscious of these factors. Some operators have found that when trucks are overloaded, the tire life decreases in proportion to the percentage of overload. Rocks on the dump or on the road, especially if large or sharp, cause an abnormal amount of tire failures. This condition can be remedied by using our road patrols more or by putting on additional labor. Wet and slippery conditions, especially during the rainy season in the fall or during the spring break-up, cause more damage to tires than any other factor, and about the only way this can be remedied is to build and maintain better roads. Few of us have paid any attention to the small cuts in our tires, but, from now on, we will have to repair such cuts immediately after they appear, for in this way the tire life will be much greater. Some operators are thinking of putting in their own tire-repair department so that they can take care of these cuts immediately. This will give them quicker and better service on repairs. To date, retreading has been more of an experiment than actual practice; however, from now on we will all have to take our tires off before they are worn out and have them retreaded. This not only saves rubber, but is an economy because the retreading of a tire costs about one-third the price of a new tire. Recent inspection of used tires on the range by the major tire companies discloses that one tire out of every two would be suitable for retreading. Two companies on the range have had experience with retreaded tires and are well satisfied that these tires will perform as well as new tires. Tire life on the rear-dump trucks averages 2,300 hours on the rear 1,400x24 tires, and on the front 1,200x24 tires, the average is 3,500 hours.

Number of Spare Trucks—In these times when we are all working our equipment 20 shifts a week and as close to 365 days a year as possible, we do not have the usual sixth or seventh day for repair work; neither do we have the three or five-month period for so-called winter repairs; so it is essential that we know or have a good idea of how many spare truck units are required to keep a given number of trucks on the operating line. The major factors to be considered are not only the servicing and the minor break-downs, but the repair jobs, such as overhauling the engine, transmission, and clutch, relining the brakes, and repairing the box, which probably account for most of the delays. Even though we all try to carry a spare engine, transmission, dump box, and rear-axle assembly in stock, much time is lost in making such replacements. After doing everything possible to cut down the time necessary for repairs, even to working repair crews on the night shifts, the experience of most operators on the range is that two stand-by units are required for every ten trucks in operation.

Another question is: How many service or repair men are necessary to keep a fleet of trucks in good operating condition? From the information gathered it appears that it takes one serviceman or repair man one shift for every three shifts a truck is in operation; or, in other words, 8 hours of repair and service work is required for each 24 hours of truck operation. However, this situation may vary on different operations, depending on the number and type of units that are being used in each fleet.

Truck Life—I believe that the life of the rear-dump trucks has been pretty well determined to be at least 15,000 hours as compared to the figure of 10,000 hours that we all used originally. A number of them have been in operation that long and are still doing their jobs even beyond the 15,000 hour period. Such being the case, the original hourly depreciation figure as set up some years ago would be reduced by 33 percent, or the depreciation on the rear-dump trucks would be $0.70 per hour instead of $1.06 as originally used. These figures do not include interest on the investment nor the purchase price of the original set of tires which would come with a new unit. I doubt whether this reduction of $0.36 per hour should all be considered a reduced depreciation cost, as part of it will be put back into the truck by reason of the higher maintenance costs during the final hours of operation. This point was brought out by Grover J. Holt in the paper he presented in 1939. The foregoing depreciation figures do not include any trade-in or salvage value to the truck at the end of the depreciation period, for I think we will all agree that these trucks do have a fairly substantial value at the end of 15,000 hours. Although we set up a certain number of hours as being the life of a truck, I am of the opinion that high maintenance costs and obsolescence may determine the economical life of these machines.

Hydraulic Steer — The hydraulic steering device was installed on a fleet of trucks last spring and has proved very satisfactory. This mechanism does away with about 80 percent of the manual effort required to steer, so that the large trucks can be handled with as little effort as the modern passenger automobile. This hydraulic mechanism is so arranged that if the pump or any part of the hydraulic machinery should fail, the truck will steer as it did before the installation was made.

Application of hydraulic steering seems to be a step in the right direction. Though the element of driver fatigue cannot be measured, we all know that it is present, especially toward the end of a shift; so anything that we can do to relieve this condition tends to make a more efficient and safer operation.

Fluid Coupling—This type of coupling has been in operation on the range since 1939 and was discussed by P. S. Gray in his paper presented in 1940. It takes the shock load away from the clutch, transmission, differential, and rear axle and tends to smooth out the general operation of a truck, especially in starting. However, it does not eliminate gear shifting on the grades, as the right gear must be picked before starting to negotiate a grade. The maintenance of these couplings may add some little cost to the operation, but, no doubt, this additional cost is overcome by the lesser wear and breakage on the clutch, transmission, differential, and rear axle. I think some discussion of the fluid coupling would bring out more points of interest.

Oil Filters—Some operators are using additional oil filters on their engines to increase the time between oil

Coming out of the pit on its way to the washing plant—a truck at one of the Mesabi open-pit mines

changes from 70 hours to 250 hours. Though there has been some discussion as to whether this practice is safe and economical, some of the oil companies have recommended that it is safe to use their oil in the crankease for a period of 250 hours if these additional filters are used. As to the economics, lubricating oil in the crank case costs $3.60 per change. By using the additional filters, one oil change is made instead of the usual four changes, so a saving of $10.80 is made for each 250 hours of truck operation. If we assume a 15,000-hour truck life, the total saving on oil per truck would be $650. However, the cost of the original filter and the replacement elements must be deducted from this figure, so the net saving would probably amount to $400 per truck during its life.

Solution Used in Truck Boxes—Most of us are operating our trucks on stripping work during the winter months, which means that we all have more or less trouble with the material freezing in the boxes. Many different solutions are being used to keep the material from freezing thus; namely, hot salt brine, which is sprinkled on the boxes; diesel oil, which is sprayed on; or calcium chloride, which is applied in solution or its natural state. Besides using these solutions, some operators equip their truck boxes with an apron made either of belting or light steel plates. Certainly there must be some advantage in the use of these solutions over the others, for, in the case of locomotive and car operations, we were all agreed that salt brine was the best to use. I cite this just to show that we do have a meeting of minds on some of these problems, so if this matter is discussed, it is possible that we will get some ideas which may prove of value in our operations, as well as save some of our "religion."

General—We have all had experience with the road patrols and bulldozers and probably have tried to use each of these machines for work which it was not designed to do. The patrols will do a good job of maintaining our haul roads; also, when they are equipped with a bulldozer blade, they will do light bulldozing work on the dumps. However, they will not do the heavier work required of a tractor. The tractors equipped with a bulldozer will not do a good job of maintaining roads, but they will do very good work cleaning up around the shovel as well as maintaining a dump.

Some companies have built tarvia or cement roads in their pits which should give longer tire life as well as a much smoother surface to operate trucks on. O. L. Kipp, of the Minnesota Highway Department, last year made public a paper on the construction of haulage roads. Since then operators have had experience with this work and are in a position to discuss the merits of improved roads in pits.

Timmins Ochali's Safety Work Headed by Management

Welfare activities also receive careful attention

Forbes K. Wilson and Balfour F. Darnell

Manager and General Superintendent, respectively, Timmins Ochali Mining Co., Yarumal, Antioquia, Colombia

SAFETY WORK conducted by the Timmins Ochali Mining Co., at Yarumal, Colombia, is directed by a general committee composed of all department heads and assistants, with the manager as chairman and the safety engineer as secretary. The mine, mill, mechanical, and surface departments have their own safety committees which include department heads and all native bosses. Monthly meetings, under the direction of the safety engineer, are held in all departments to review and classify any lost-time accidents, discuss operating practices and equipment to prevent similar accidents, and to revise and amplify operating safety rules previously formulated.

At the start of the safety campaign, late in 1938, a book of safety rules was drawn up in Spanish and a copy was given to each workman. In formulating rules to cover all operations, we made liberal use of the safety experience of operating mines in both North and Latin America and added other rules which applied to our particular problems. From time to time examinations, based on the safety rules, are given to groups of workmen to refresh them on safety related to their specific duties. In the mine all men have to pass an oral examination on the handling of explosives before they are eligible for promotion from helpers to miners. This examination is conducted by the bosses.

In eliminating accidents one of the most effective measures has been the formulation of a standard practice for each major operation. These standard practices were worked out by the department heads, safety engineer, and local bosses. This was followed up by holding bi-weekly "schools" at some point of actual operation where a complete group, such as miners, timbermen, muckers, or trammers could be present. Workmen were selected to demonstrate proper methods to the assembled group. Photographs were taken on the scene, illustrating both correct and incorrect methods, and published with comment by the safety engineer on the various safety bulletin boards in the different departments and in the various divisions of the mine underground.

As the work progressed, the running of department meetings was turned over to the local bosses, who carried on the discussion of safety measures with comment and suggestion from the safety engineer and department head. This practice has tended to make all shift bosses thoroughly safety-conscious, and they in turn have effectively placed their ideas before the workmen under them.

From the start of the campaign the workmen have shown a keen interest in safety, and their cooperation is reflected in a continued improvement in the record from year to year in all departments, shown in the accompanying table.

In the three-year period covered there was a corresponding reduction in the severity rates. The man-shifts lost per 1,000 shifts worked dropped from 28.5 in 1938 to 15.6 in 1939 to 8.3 in 1940, a steady decline.

During several weeks of each year night classes are held by the safety engineer on first-aid training. All local shift bosses, many of the mine contractors and most of the mill operating crew have been trained in this school run by the company.

In the mine all workmen are supplied with Edison electric cap lamps, skulgard hard hats, and goggles. In other departments workmen are supplied with and required to use gloves, goggles, and dust and gas masks in ac-

Lost-Time Accidents, 1938-1940 Inclusive

	Number of Shifts	Lost-Time Accidents	Accident Rate Per 1,000 Shifts
1938	114,703	284	2.52
1939	157,358	198	1.26
1940	155,553	86	0.55

cordance with the safety rules and the conditions under which they work.

Welfare — Because of the isolated position of the mine and lack of housing facilities, it was necessary for the company to take part in the building up of a small community at the same time that the mine was being developed and the mill constructed. To eliminate a rapid turnover of employees who were being trained to operate machinery and work with modern mining methods, we started a policy of subsidizing the building of houses on company property for married men who desired to bring their families to the mine. The subsidy consists of a loan of money to purchase houses already constructed or loan of materials at cost for new construction, the loans being repaid in small monthly installments free of interest. At present 200 houses, built under this arrangement, are owned by the workmen. The population of the immediate community, including people living both on and off company property, is put at 2,300.

To take care of single men three modern bunk houses were constructed. Each has a recreation room supplied with radio, reading matter, and games. A mine change room, equipped with lockers and hot showers, was built near the portal of the 1860 level.

A school house, with a capacity of 100 pupils, was also built and turned over to the Colombian Government, which operates it for the education of workmen's children. Subsequently, other schools were built and operated by the Catholic Church.

With the growing community, numerous small private enterprises were started in the form of stores and kitchens for the sale of supplies and foodstuffs to both workmen and private individuals. As a control on price of foodstuffs during shortages, the company opened a grain store where workmen may buy certain prime necessities at cost. By making large purchases during the harvest seasons, the average annual prices of these necessities has been maintained considerably below the current prices quoted in neighboring towns.

Over and above the guarantees that workmen receive under Colombian law, the company has instituted the following benefits: (1) Payment of one day's wage for each month of service to men who are laid off because of reduction of personnel. (2) Half pay to workmen who are confined because of illness. (3) Payment of two days' wages monthly to all underground workmen who complete, without loss of time, 26 consecutive working days not including Sundays. (4) Vacations of eight days with pay for all workmen who complete 280 shifts within a 12-month period.

The company operates a hospital the staff of which includes two doctors, two nurses, and a druggist. In it all accident cases and serious illnesses are taken care of. Free medical consultation is also extended to the families of workmen. In addition, the medical department operates a prophylactic station for prevention and cure of venereal disease. This arrangement was made possible through the cooperation of the Colombian Government, which supplies necessary drugs free of charge.

Recently the company completed a theater with a seating capacity of 400, equipped with two sound-projection machines for motion pictures, which are shown twice a week. Adjoining the theater there is a small chapel which is used as a shrine and for the hearing of mass on special religious holidays. Below the theater there is a workmen's social hall, open at all times and equipped with billiard tables, games, and reading matter.

Lake Ore Shipments by Grades

1941 tonnage almost three-quarters non-Bessemer

AVERAGE ANALYSES of the 1941 shipments of Lake Superior iron ores by ranges and grade classifications are given in the accompanying table issued by the Lake Superior Iron Ore Association, Cleveland, Ohio. The ores are classified as Bessemer (not over 0.045 percent phosphorus); Low-Phosphorus Non-Bessemer (over 0.045 percent, not over 0.180 percent phosphorus); High-Phosphorus Non-Bessemer (over 0.180 percent phosphorus); Manganiferous (2 percent manganese and over); and Siliceous (18 percent silica and over). Tonnages are all expressed in B/L weights, all-rail being reduced to the same basis as Lake shipments. In the tabulation for "Combined Ranges" only the shipments from the six ranges of Minnesota, Michigan, and Wisconsin are included.

Average Analyses of Lake Superior Iron Ores, 1941 Shipments

	Tonnage		Fe				
	Shipped	% of Total	(Nat.)	P	SiO_2	Mn	Moist
Marquette Range							
Bessemer (*a*)	125,559	2.0	55.19	.042	6.73	.21	11.11
Low-Phos. Non-Bess.	5,233,049	85.0	52.89	.110	8.61	.33	10.04
High-Phos. Non-Bess.	16,398	0.3	55.37	.183	10.50	.10	3.94
Manganiferous	.....	....	....	....	....	....	....
Siliceous	778,960	12.7	36.98	.043	42.70	.09	2.69
Range Total	6,153,966	100.0	50.93	.100	12.89	.30	9.12
Gogebic Range							
Bessemer	900,581	14.4	54.55	.047	8.36	.50	10.41
Low-Phos. Non-Bess.	5,083,151	81.5	52.58	.073	7.64	.78	12.42
High-Phos. Non-Bess.	.....	....	....	....	....	....	....
Manganiferous	255,023	4.1	51.98	.062	7.48	2.66	10.21
Siliceous	.....	....	....	....	....	....	....
Range Total	6,238,755	100.0	52.84	.069	7.74	.82	12.04
Menominee Range							
Bessemer	.....	....	....	....	....	....	....
Low-Phos. Non-Bess.	872,877	21.2	53.89	.055	9.89	.16	7.11
High-Phos. Non-Bess.	3,142,670	76.1	51.78	.454	6.75	.26	8.47
Manganiferous	.....	....	....	....	....	....	....
Siliceous	112,878	2.7	37.10	.018	44.44	.09	2.07
Range Total	4,128,425	100.0	51.83	.358	8.44	.24	8.01
Vermilion Range							
Bessemer	513,179	29.5	56.19	.044	8.18	.10	6.81
Low-Phos. Non-Bess.	1,224,877	70.5	57.82	.084	7.83	.09	4.74
High-Phos. Non-Bess.	.....	....	....	....	....	....	....
Manganiferous	.....	....	....	....	....	....	....
Siliceous	.....	....	....	....	....	....	....
Range Total	1,738,056	100.0	57.40	.073	7.93	.10	5.35
Mesabi Range							
Bessemer	15,799,644	26.7	54.81	.039	7.93	.35	9.15
Low-Phos. Non-Bess.	43,333,684	73.1	51.07	.068	7.51	.74	12.30
High-Phos. Non-Bess.	.....	....	....	....	....	....	....
Manganiferous	91,223	0.2	50.09	.073	9.62	2.58	8.35
Siliceous	33,249	0.0	42.33	.040	29.37	.52	6.50
Range Total	59,257,800	100.0	52.07	.060	7.64	.64	11.45
Cuyuna Range							
Bessemer	.....	....	....	....	....	....	....
Low-Phos. Non-Bess.	16,836	0.7	47.04	.166	12.67	.62	12.49
High-Phos. Non-Bess.	326,547	13.5	47.39	.257	9.24	2.14	11.44
Manganiferous	2,065,712	85.2	41.31	.229	10.37	7.58	11.55
Siliceous	15,143	0.6	42.07	.096	24.50	.69	9.52
Range Total	2,424,238	100.0	41.85	.232	10.32	6.75	11.53
Combined Ranges, U. S. A.							
Bessemer	17,338,963	21.7	54.87	.039	7.95	.35	9.16
Low-Phos. Non-Bess.	55,764,474	69.8	51.56	.072	7.67	.69	12.80
High-Phos. Non-Bess.	3,485,615	4.3	51.39	.434	7.00	.44	8.73
Manganiferous	2,411,958	3.0	42.77	.205	10.04	6.87	11.29
Siliceous	940,230	1.2	37.27	.040	42.14	.11	2.86
Grand Total	79,941,240	100.0	51.83	.085	8.18	.78	11.01
Michipicoten Range, Canada							
Bessemer (sinter)	456,140	100.0	50.34	.019	10.51	2.95	.91

The "Double-Step" Liner for Ball Mills

Design thought adaptable to any suitable material

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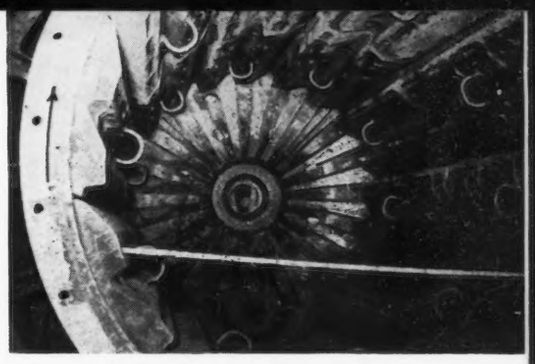

New installation of slotted double-step end and shell liners in a 5x10-ft. Marcy open-end primary ball mill. Note that lifters on end and shell liners match. The loops have been tacked temporarily to the liners to facilitate handling

THE DESIGN of ball-mill liners, here described, which has become known as the "double-step" type, was worked up by myself. It has been tested thoroughly at three different properties, in primary and secondary mills, as end liners as well as shell liners, in comparison with a wide variety of types in common usage. Results have varied from a minimum saving of about 20 percent of liner cost per operating day to a maximum of 46 percent in liner cost per ton of ore ground. In one plant the reduction in liner cost was about 4,000 annually.

The table shows a profile of the various types of liners used, with comparative performances expressed in terms of operating days per liner of given initial weight. Some of the mills showed substantially higher capacity with the double-step liners, but this was not taken into account in the table.

The object of the double-step design is to reduce to a minimum the slippage between ball charge and liner without interfering with the ball action. The ball charge is keyed to the liner by alternating valleys and lifters proportioned according to the maximum size of ball used in the charge. The design usually works out with the lifters about one ball diameter in width and the valleys slightly wider. See Fig. 1.

The shape, width, and depth of the valley is important. It should not be so deep, narrow, or tapering that balls will wedge and fill it. Wedged balls soon grind off flush with the top of the lifters and in effect leave a smooth surface to the liner. Excessive slippage then takes place, with accompanying rapid wear and loss in capacity. The valley should not be so deep that balls will seat deeply and be carried nearly around the periphery of the mill. When this occurs, capacity is reduced. The trailing wall of the valley is sloped so that the balls will fall freely from the valley at the height of their path.

The lifter should be about twice as wide as its height. If the lifter is too narrow, it soon forms a knife-edge which peens excessively and wears rapidly. The comparatively close spacing of the lifters gives a rippling ball action which may account for the increased capacity that has been experienced. Absence of slippage also probably contributes.

In adapting the double-step liners to the bolt intervals in existing mills, the design usually works out whereby the bolt is placed in the valley between the lifters. This has proved to be advantageous because, for a large share of the time, the bolt head is in a zone protected from the impact of the balls. The pronounced tendency of the liners to "grind in" their own lifters, plus the migration of the point of lift, leaves the bolt in what becomes ultimately the thickest part of the liner when it finally wears out. Likewise, the wear is concentrated in an area away from the joints between liner sections, a desirable condition. The broken lines in Fig. 1 illustrate the progressive wear. The thin sections remaining indicate the low scrap loss that is found with this type of liner.

Although all of the experience to date has been with manganese steel, the design seems to be adaptable to any suitable lining material. U.S. Patent No. 2,274,331 has been issued on the development.

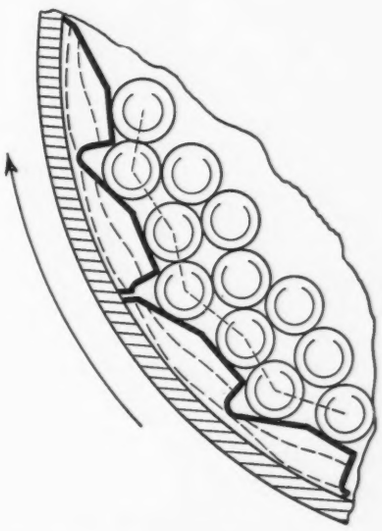

Fig. 1 . . . Diagram of keying effect of double-step liners. Curved broken lines indicate progressive wear

* Formerly mill and smelter superintendent, Mammoth-St. Anthony, Ltd., Arizona.

Table I. Comparative Service of Various Types of Liners, All of Manganese Steel

Profile	Type	Mill A			Mill B			Mill C			Mill D**		
		Wt. Lb.	Op. Days	% Saving	Wt. Lb.	Op. Days	% Saving	Wt. Lb.	Op. Days	% Saving	Wt. Lb.	Op. Days	% Saving
	Double-step	17,959	128	29.3	9632	*** 330	19.8	13,497	185	31.2	1730	142	45.2
	Block	19,420	98										
	Wave							18,439	172		1800	80	
	Shiplap				8646	238							

** *End Liners. All other mills, shells.*
*** *Estimated minimum life after 180 days service. Secondary mill. All others primary.*

Herman's Method for the Determination of Mercury

Ultraviolet lamp and fluorescent screen used to detect volatilization losses—Use of this apparatus is particularly applicable to concentrates of livingstonite, mercury-antimony sulphide

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THE STANDARD Whitton method for determining the mercury content of an ore depends on the volatilization of the mercury and its subsequent condensation on a gold or silver plate. Failure to volatilize all the mercury will give a result too low, as will failure to condense all the volatilized mercury. The deposit of other materials on the plate, if it occurs, would give too high a result.

Herman[1] has improved the Whitton method by the use of an ultraviolet lamp and a fluorescent screen. Mercury vapor is opaque to ultraviolet light, and so, when the mercury assay apparatus is placed between the ultraviolet lamp and the fluorescent screen, any leakage of mercury from the apparatus will show up as a smoky shadow on the screen.

Furthermore, with this arrangement the charge can easily be tested at the end of a run to see whether mercury has been retained, and the apparatus can likewise be tested. Herman regularly uses the lamp and screen to prove the accuracy of his determination, and, as a result of the information gained from its use, he has designed a more suitable, more leak-proof apparatus than the standard Whitton, and he has materially altered procedure.

The Apparatus—This consists of a crucible about 4 in. long with an internal diameter of $\frac{15}{16}$ in. and an external diameter of $1\frac{1}{8}$ in., which gives walls $\frac{3}{32}$ in. thick. It is made by machining and drilling a piece of 2-in. diameter cold-rolled steel shafting. At the upper or open end a recess is machined on the outside and a $\frac{3}{16}$-in. flange $1\frac{3}{4}$ in. in diameter is formed. A riser $\frac{1}{16}$ in. wide and $\frac{1}{16}$ in. high is machined on the top surface of the flange and the edge of this riser is made perfectly smooth and true. This forms the seal with the foil. A steel plate $4\frac{1}{2}$-in. in diameter and $\frac{3}{8}$ in. thick has a central hole drilled to the outside diameter of the crucible; it is shrunk onto the crucible at the upper end so that it engages the recess referred to in the foregoing. Two upright bolts 4 in. long and $\frac{3}{8}$ in. in diameter are fastened to this plate with the nut ends upward. They are attached at opposite ends of a diameter of the steel plate and are machined at their upper ends for $\frac{3}{4}$ in. below the nut to form recesses to hold a clevis.

The silver foil is placed on the smooth-edge of the riser. A brass crucible $3\frac{3}{4}$ in. in diameter by $2\frac{3}{4}$ in. high, and having a flat and smooth bottom surface, sets on the foil. It has a central bar across the top which serves to receive the clevis. Pressure is applied with the clevis to give a perfect seal between the foil and the crucible.

This apparatus has the following advantages over the Whitton:

1. There is no internal surface of the crucible that is not subjected to heat and hence no surface of the crucible itself on which mercury can condense.
2. The crucible is high enough to permit use of a 1-gram charge and sufficient fluxes and cover filters to absorb all the sulphur.
3. A sufficiently tight joint can be made between foil and crucible so that leakage of mercury will not occur even under the very high pressure caused by the volatilization of the large quantity of mercury in high-grade concentrates.

Preparation of Charge—The sample is dried for four hours at 105 deg. C., mixed by rolling, and 1 gram is weighed out for assay. To this is added the following flux: lime, 15 grams; iron filings, 10 grams; and iron powder (alcoholized), 10 grams. This flux and the 1-gram sample are thoroughly mixed with each other and put in the Herman crucible.

A cover of 10 grams of lime is put on top of the charge and a second cover of 15 grams of iron filings is put on top of the lime cover. These serve to filter and retain any sulphur that is not absorbed by the fluxes of the charge. The charge and flux fills about $1\frac{1}{2}$ in. of the crucible, the covers about another $1\frac{1}{2}$ in. The iron crucible is heated to redness before use to remove organic matter.

Silver foil is used. It is first cleaned by rubbing it on a glass plate with a piece of soap. When smooth it is washed first with water, then with alcohol, and dried at a dull red heat. When dry, it is accurately weighed and set on top of the crucible. The metal receptacle for water is centered on top and the clamp put in place and drawn up as tight as possible.

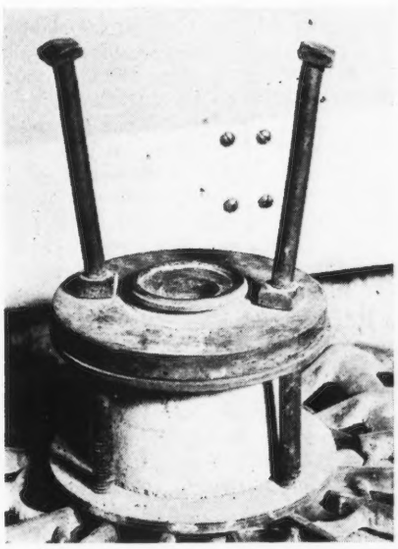
The Determination—The apparatus is put on a gas burner so that it is between the ultraviolet lamp and the fluorescent screen. The room is darkened but need not be entirely dark. A moderate flame is turned on so as to heat the crucible slowly, and the screen is watched. Water from a vessel overhead constantly trickles into the brass crucible to keep the silver foil cold. If at the end of a half hour no smoky shadow has shown on the screen, the flame is gradually raised until all but the top inch of the crucible is a bright red, and it is maintained that way for four hours. The heat is then turned off and the apparatus allowed to cool until it is practically at room tempera-

Data for Four Tests Made With Herman's Method

	Test No. 1	Test No. 2	Test No. 3	Test No. 4
Heat turned on	8:30 a.m.	8:30 a.m.	8:30 a.m.	8:30 a.m.
Heat raised	9:10 a.m.	9:40 a.m.	9:00 a.m.	9:00 a.m.
Heat turned off	1:30 p.m.	2:00 p.m.	1:30 p.m.	1:30 p.m.
Original weight of (grams):				
Plate	7.4215	7.1945	7.4221	7.1956
Plate plus mercury	7.4887	7.2614	7.4891	7.2617
Difference	0.0672	0.0669	0.0670	0.0661
Plate after heating	7.4221	7.1952	7.4225	Not weighed
Difference	0.0666	0.0662	0.0666	
Tests for retention				
Charge	No smoke	No smoke	No smoke	No smoke
Lime cover	No smoke	No smoke	No smoke	No smoke
Iron cover	No smoke	No smoke	No smoke	No smoke
Apparatus	No smoke	Slight smoke	No smoke	Slight smoke

[1] John Herman, assayer and chemist, 771 San Julian St., Los Angeles, Calif.

The burner base. The other pictures show subsequent steps in assembling the apparatus



The steel plate shrunk onto the crucible is resting on the burner base

Silver foil on which the mercury vapor is condensed rests on the crucible

The brass cooling crucible here is resting on the silver foil

Assembled apparatus is between the ultraviolet lamp and the fluorescent screen

ture. This takes from 1 to 1½ hours. Then the apparatus is disassembled and the silver plate is washed in alcohol to remove any water or oil, then dried and weighed. The silver plate with its mercury deposit is then put on the burner and heated to redness until the screen shows no more smoke, indicating that all the mercury has been driven off. After cooling the plate is again weighed. The assayer, therefore, has three weights:

1. Original weight of plate.
2. Weight of plate plus mercury deposit.

Difference A=weight of mercury=2-1

3. Weight of plate after driving off mercury.

Difference B=weight of mercury=2-3

Difference B may be slightly smaller than difference A; in such cases it is due to dust or lime from the charge settling on the plate. In every case the lower figure is taken.

Tests for Retention of Mercury—The apparatus is unloaded in sections as it is filled; that is, the iron cover, the lime cover, and the charge. Each one of these is tested for mercury retention by taking a little of the material on a spatula, holding it in the gas flame, and observing whether there is any smoky shadow on the screen. After all three have been tested, the crucible, without any cover, is put on the gas flame and heated to redness. If any mercury has been retained in the crucible, it will show as a smoky shadow on the screen.

When either charge, covers, or crucible show any perceptible retention, the determination is discarded and another one run in its place.

Four determinations of mercury on a lot of ore were made in my presence and in each the procedure was exactly as detailed herein. The results are presented in the accompanying table.

Tests Nos. 2 and 4 showed some mercury retention in the apparatus in that there was a slight smoky shadow on the screen when the apparatus was reheated. The results of these two were, therefore, discarded as low. The results of tests Nos. 1 and 3 were an absolute check at 6.66 percent, and this value was reported.

At my request one foil, that of test No. 4, was cut up and used for special tests to show whether anything other than mercury had been deposited. A small piece of the foil from one corner that had not been exposed to the mercury was cut out as a control and another small piece from the center of the foil with its deposit of mercury still on it was also cut out.

Separate spectrographic photos of the control silver foil and of the mercury-coated foil were taken and compared. The control silver foil showed as minor impurities copper, lead, zinc, bismuth, tin, iron, calcium, and magnesium; the mercury-coated foil showed these same impurities in like amount. The calcium line may have been a shade more pronounced in the mercury-coated foil, but the difference was too small to count. Antimony was not shown in either. The mercury-coated foil differed from the control only in that it showed the mercury lines.

What remained of the foil was tested for sulphur by chemical methods. The deposit was dissolved in nitric acid and potassium chlorate, and the solution acidified with hydrochloric acid. The precipitated silver chloride and mercurous chloride were separated by filtration and barium chloride was added to the filtrate. No precipitate of barium sulphate came down, proving that sulphur had not been deposited on the foil.

Filtering Cyanide Slimes

Careful sampling is important if gold loss is to be held to minimum—Washing capacity must not be overestimated

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AN IMPORTANT SOURCE of gold loss in cyanidation can often be found in the final treatment stage, filtration. This discussion relates principally to methods of sampling, assaying, and calculation of efficiencies in filtering plants. Operating data from two radically different plants are given. The differences shown in solution or gold recoveries in the two plants are due largely to the character of the slime treated and do not imply that the one type of filter has inherent advantages over the other.

Filtration in cyanide work functions to conserve water and chemicals for reuse, and to apply a final wash for removing as much dissolved gold as possible before the residue is sent to waste. Filters are sometimes used for dewatering in the earlier stages, but this article deals only with tailing filters. Washing capacity of all types of filters is often overrated. Quite as often serious losses go undetected due to faulty sampling and assaying.

Dissolved Losses—These are reported in terms of dry slime tonnage, and there are numerous ways of arriving at this figure. An accurate sample is the primary requisite, and to obtain one is often difficult and sometimes impossible. The type of filtration equipment used has an important bearing on choice of method.

Intermittent filters, such as the Moore and Butters, discharge tailings in cycles. There is dissolved metal in the cake on the leaves which can be sampled and measured, but the dissolved metal in the filtrate *inside* the leaves, which is discharged with the cake as a rule, escapes without determination. In a well-conducted operation this loss should be small. Actual determination of this fraction of the tailing value would mean the collection and mixing, for sampling, of all pulp leaving the plant. In most cases this would not be possible or advisable. A relative measure of this indeterminant loss is found in the value of the effluent at the end of the washing cycle, but the actual loss cannot be calculated from this alone.

Continuous filters such as the Oliver, FE, and similar designs make sampling comparatively easy and accurate, especially if the cake is repulped. The discharge of a repulper is an ideal sampling point, but in the absence of this equipment it is necessary to sample the cake as it falls from the drum. In most filters the cake is released by low-pressure air, and when this is admitted a small amount of solution is forced back through the filtering medium. This "blow-back" contains dissolved metal, and when the sample is taken from the drum there is always uncertainty regarding the inclusion of "blow-back" solution. The amount of loss from this source is a matter of controversy. Regardless of its magnitude, it is a factor that must be considered.

In practically all instances final filtration is accompanied by sudden dissolution of gold. The amount dissolved usually is small—sometimes of the same magnitude as the final dissolved loss. Therefore it is never a certainty that dissolution stops when the tailing sample is taken and it is advisable to prevent dissolving action by adding a chemical that will destroy free cyanide and still leave dissolved gold in the sample as such. Potassium permanganate meets this requirement and does not interfere with subsequent assays.[1] Use of a "fixer" such as this permits determination of the true dissolved loss. As to recovery calculations, it is immaterial whether or not dissolution takes place in the sample so long as the total of undissolved and dissolved gold is determined, but the calculation of a high dissolved loss in the sample might lead to false conclusions and to an attempt to save value not recoverable.

Use of permanganate means that the filter cake must be repulped in a solution of it or, if the sample is taken from a repulper, mixed thoroughly in a sample container into which crystals of permanganate have been placed. It is well to keep the sample at about 50 percent solids, and the pulp must be thoroughly mixed each time a fresh cut of sample is added. If the pulp has a uniform pink color, the operator is assured that free cyanide does not exist in the sample.

Assay—There are two general methods of assaying for dissolved loss. The old method of a fire assay on washed and unwashed portions from the same sample is still practiced although incorrect. The procedure is based on the assumption that the difference between the two assays is dissolved gold. As a matter of fact, the method yields a result lower than actual, probably due to partial volatilization of gold-cyanide compounds in the unwashed pulp. In one instance I found that it gave results about 50 percent lower than the direct determination by solution assay. Even if all the dissolved gold were reduced and recovered by fire assay, it would still be hard to make a reliable determination because of the small weight differences in the prills from the washed and unwashed assays. Good filtration gets dissolved losses of 0.05 dwt. per ton of slime, and less. For a one-assay-ton fusion the direct weighing of such a small amount of gold is too much to expect with the usual assay balances used.

A more reliable method is to determine the undissolved gold in a washed portion by fusion and the dissolved gold in the filtrate by a solution assay. As a rule the solution assay is accurate and from it the proportion of dissolved gold in the original can be calculated from the dilution ratio of the pulp.

An appreciable error can be made in determining pulp dilutions, and the following method was devised to do this accurately and at the same time check the calculations. The method avoids use of pulp tables, which in most cases must be calculated to fit a specific ore. A liter-graduated cylinder and a set of scales, sensitive to 1 gram, constitute the necessary equipment. The clean graduate is first weighed empty and then weighed full to the liter mark with clean mill-supply water. The latter step is necessary to check the volume marking, because some marks are sufficiently in error to be shown in this manner. Once the graduate has been checked for tare weight and volume it should be reserved for this determination.

Table I—Report Form for Tailing Assay

(Gold in Dwt. per 2,000 Lb.)

	No. 1	No. 2
Wt. of graduate and pulp, grams	1,955	1,960
Wt. of graduate	544	544
Wt. of pulp (1000 cc.)	1,411	1,416
Wt. of dry filter cake	646	648
Dilution ratio	1.18	1.18
Assay of filtrate	....	0.12
Dissolved gold, per ton slime	....	0.141
Undissolved gold, per ton slime	....	0.51
Total gold, per ton slime	....	0.551

[1] "Note on the use of certain cyanicides in the estimation of undissolved gold." H. A. White. *Chem., Met., Min., Soc. South Africa Jour.*, Vol. XII, No. 3.

To determine the dilution ratio of a pulp the graduate is filled with a representative sample. One liter should be taken to simplify calculation, but the actual volume is immaterial so long as sufficient solids are present for manipulation of the cake and final weighing. Percentage of error in the operation decreases as the weight of dry solids increases in a given volume. Two portions should be weighed in this manner and filtered separately as an initial check. After drying the filter cakes, the results can be calculated readily as shown in Table I.

Following precautions must be observed: (1) thin sample pulps should be avoided if possible; pulps at 50 percent solids and more give accurate checks and are easiest to handle; (2) the sample pulp must be free of lumps; (3) *all* of the filter cake must be recovered for drying and weighing; Buechner filtering funnels are best adapted to this.

The specific gravity of the dry slime can be calculated directly from the data in Table I, and this serves as a check on the work because in any plant the specific gravity of the ore is nearly a constant. The calculation is made as follows:

Calculation Basis	No. 1	No. 2
Weight of dry slime	= 646	648
Volume of dry slime	= 235	232
Specific gravity	= 2.77	2.78

This calculation assumes that the specific gravity of the solution is unity, which is not strictly true. The error is usually of small consequence because of possible errors in sampling and weighing that are probably of similar magnitude and compensating.

Gold Balance of a Continuous Filtering System—For purposes of a plant test it is impractical to determine the actual tonnages and values of filter feed, effluent, and tailings which would give a basis for calculating the efficiency of the system; in fact, the procedure would be almost impossible. However, it is possible to determine recovery by sampling feed and discharge pulps, calculating the dilution ratios, and obtaining the gold recovery by difference. Variations in slime tonnage do not affect the determination's accuracy, but the volume of feed pulp should be kept as constant as possible during the sampling period. As most filters are fed from a thickener by means of a diaphragm pump, this condition is easy.

This procedure was followed in checking the efficiency of the installation sketched in Fig. 1. The primary filters were 11½x14 ft., rotary type, and were fed from a common distributor. The drums were covered with No. 175 twill-weave canvas and their speed was 0.4 r.p.m. A barren solution was applied as shown in Fig. 2. This permitted a flooded surface on the upcoming side of the drum as well as on the discharge side. Ordinary kitchen-grade oilcloth laid in the angle iron along the length of the drum was effective in catching excess wash solution, preventing dilution in the filter tank. The run-off solution from this launder plus that from the discharge side of the drum were usually sufficient for repulping the cake of the two primary filters.

The common repulper was 1½x12 ft. and the shaft was direct-connected to a 3-hp., 115-r.p.m. gearmotor. The shaft consisted of a length of 4-in. pipe turned at the ends to give bearing and packing surfaces. It was supported by outboard bearings and was equipped with a water seal at the glands. The entire repulping installation was made in the shop. The detail of the secondary-filter repulper

Table II—Two-stage Filtration: Solution Recovery

(Gold in Dwt. per 2,000 Lb.)

	First Stage				Second Stage				
Test	Dilution Ratio	Feed Solution	Effluent	Recovery, %	Dilution Ratio	Feed Solution	Effluent	Dissolved Loss	Recovery, %
1	1.08	1.41	1.51	77.6	0.88	0.39	0.37	0.14	58.8
2	1.24	1.41	1.38	83.5	0.94	0.31	0.33	0.16	44.8
3	1.30	1.30	1.22	85.9	0.95	0.25	0.31	0.14	41.6
4	1.35	1.18	1.30	81.1	0.96	0.31	0.31	0.13	56.7
5	1.27	1.22	1.45	80.0	0.93	0.33	0.33	0.14	54.8
6	1.26	1.27	1.34	80.6	0.90	0.34	0.33	0.13	58.0
7	1.13	1.57	1.57	75.3	0.92	0.48	0.41	0.16	63.6
8	1.28	1.62	1.67	79.7	0.96	0.44	0.44	0.19	54.7
9	1.45	1.36	1.43	81.7	1.14	0.32	0.31	0.17	52.8
10	1.46	1.59	1.55	83.6	1.09	0.35	0.35	0.17	55.3
11	1.02	1.94	1.92	75.4	1.26	0.39	0.44	0.20	59.2
12	1.14	1.78	1.78	78.8	0.89	0.48	0.54	0.21	51.1
13	1.26	1.67	1.72	81.8	0.92	0.41	0.45	0.21	44.7
14	1.39	1.63	1.72	82.9	0.95	0.41	0.41	0.20	48.7
15	1.22	1.54	1.67	83.0	0.87	0.37	0.39	0.18	43.8
Averages		1.49	1.55	80.7		0.37	0.38	0.17	54.6

Fig. 1 . . . Plan of a filtration plant in a continuous system.

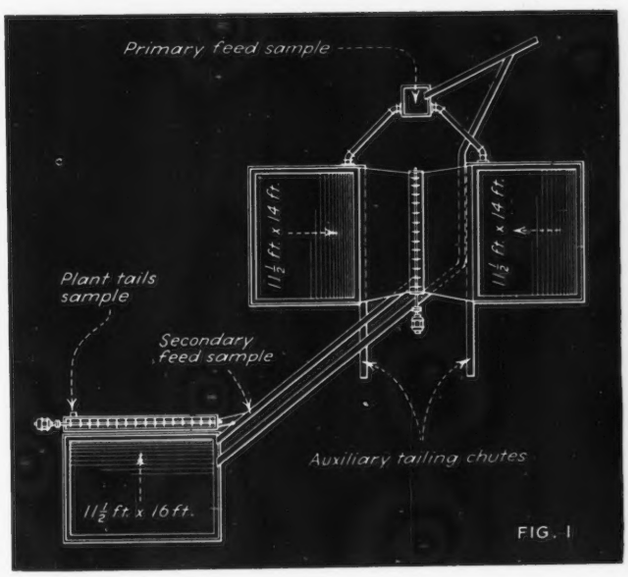


Fig. 2 . . . Applying a wash solution to the filters in Fig. 1.

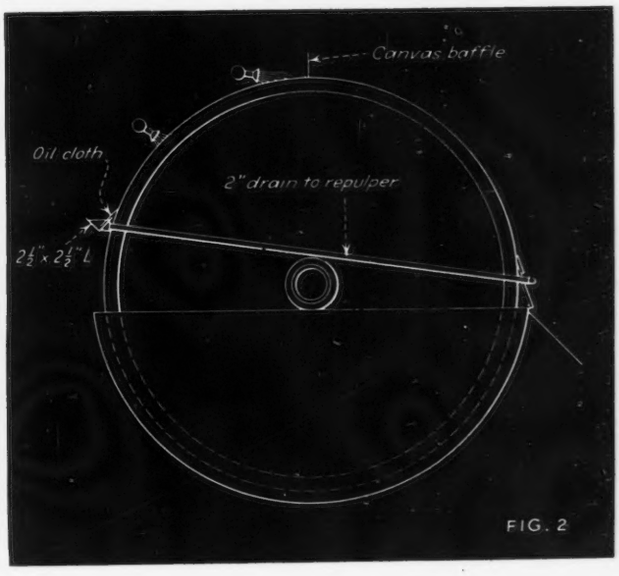


Table III—Screen Analysis of Filter Feed

On Mesh	Weight %
40	3.6
60	10.3
80	10.7
100	4.6
150	9.2
200	10.0
minus 200 sand	5.8
minus 200 slime	45.8

was the same except that it was 16 ft. long and the shaft was driven at 80 r.p.m. by a 5-hp. gearmotor.

The secondary filter was 11½x16 ft. and the details of drum covering and speed were the same as those of the primary filters. The vacuum system was common to all three filters, and a vacuum of 25 in. of mercury was maintained by a simplex vacuum pump of 425 c.f.m. displacement.

Hand samples were taken at the points indicated in Fig. 1 at 30-min. intervals. The cuts were stored in glazed-earthenware acid jars in which permanganate crystals had been placed. Sufficient permanganate was added initially to give the pulp a strong color throughout the sampling period. All samples were collected at each shift end and made into composites for assay. One portion of the composite was filtered to obtain about 2 liters of filtrate. Another smaller portion was poured into an enameled bucket and washed thoroughly by decantation to obtain a sample for undissolved gold assay. Enough was taken to yield about 1 kg. of dry cake. Usually three water washes and decantations were sufficient to remove all traces of permanganate color from the pulp, at which point it was considered that no dissolved gold remained in the slime.

The effluent from each stage was sampled continuously by means of a homemade wire sampler. A measured amount of solution was taken from the sample at the end of each shift and these portions were mixed to form a composite sample.

All pulp assays were reported as the average of five 1-A.T. fusions. The prills were weighed singly and in combination. Effluents were assayed in duplicate portions of 10-A.T. of solution each. The filtrates from the primary and secondary filter pulps were assayed in triplicate portions of 10-A.T. each. All solutions were run by the Chiddy method.

Results for a 15-day period are summarized in Table II. The average daily slime tonnage during this period was about 200. Two facts are evident: the small differences in the assays of the feed filtrates and effluents show that little if any wash penetrated the filter cake in either stage. Also, the recovery of the primary filters dropped as the dilution ratio of the feed decreased. The first fact is especially interesting in view of the particle-size distribution of the filter feed, which is given in Table III. On its face such an analysis would indicate a slime amenable to washing and filtration. This was not the case, because the minus-200-mesh slime contained considerable kaolin, which rendered the pulp relatively impervious to wash solution. This material likewise hindered settling and prevented use of a countercurrent wash preceding filtration. The fact that filter recoveries were somewhat better with thin pulps was to be expected and indicates that the testing method was reliable.

In both stages of filtering the average effluent assay was higher than the average of filter-feed solution, which indicates dissolution of gold in the operation. This is a check on the slime assays, which averaged as follows, over the same period: first-stage feed, 0.561 dwt.; second-stage feed, 0.523 dwt.; and final tailing, 0.506 dwt. per ton.

Gold Balance of an Intermittent Filtering System—This plant consisted of a ten-leaf Moore filter which recovered solution from treatment of a high-grade roasted concentrate.[2] The filter feed in this case was not given a preliminary wash; hence the amount of dissolved gold in the tailings depended entirely upon filtering practice. The dissolved loss was exceptionally high when compared to ordinary cyanide practice. On account of the small tonnage of calcine involved, the actual gold loss from this source was small, but tests were made to determine the optimum filtering cycle and to learn something of the washing characteristics of this type of filter.

Cyanidation was conducted in batches of about 11 tons of calcine at a dilution ratio of 2.5 to 1, solution to solids. The pulp compartment of the filter was fed by a gravity line from the agitators. The feed pulp settled out at this dilution if allowed to stand, and it was necessary to agitate the pulp tank with compressed air at all times except during the caking period. The filter was of standard design except that a water-wash compartment was not provided. Due to the unusual arrangement of the cyanide and precipitation plants, it was inadvisable to apply a final water wash, and what would normally have been a water tank was simply a compartment with a hopper bottom for discharging the filter cake. After completing the barren-solution wash, it was the practice to hold the leaves over the discharge compartment until the effluent pump had exhausted the solution receiver. The vacuum on the main header was then closed and low-pressure air was admitted to the leaves. This served to inflate them sufficiently to permit scraping off the cake with wooden paddles. The cake fell through to a repulper, which in turn fed a Wilfley pump that sent the tailings to storage.

A dry vacuum pump served the filter. It has a displacement of about 250 c.f.m. and maintained vacuum at 20 in. of mercury. The filter effluent constituted gold solution for precipitation and the effluent pump discharged to sand clarifiers. A twill-weave canvas, equivalent to No. 175 cloth, was used to cover the filter leaves, and, unless a hole developed in one of these, little slime load was imposed upon the clarifiers.

Due to the nature of the filtering operation it was necessary to do all sampling by hand on a predetermined schedule. The pulp tank was sampled each time before the leaves were lowered into it, and this was considered to represent the filter feed for each cycle. As the solution receiver was pumped dry at the end of each cycle, the effluent from the caking period constituted the filter-feed solution, and

[2] "Some Milling Problems at the Raub Australian Plant." E. C. Bitzer and C. B. Nines, *E&MJ*, June, 1940.

Table IV—Moore Filter Tests (After C. B. Nines)

(Gold Assays in Dwt. per 2,240 Lb.)

Caking time, minutes	1	3	5	7	9	11	13
Maximum cake, inches	¼	½	⅝	¾	⅞	1	1
Moisture in cake, %	35.5	35.7	36.6	35.6	33.8	36.7	35.7
Assay of moisture, calculated	0.87	2.07	1.66	0.25	0.49	0.65	1.26
Filter feed assays							
1. Filtrate	10.95	12.70	12.36	10.48	11.04	11.08	11.20
2. Pulp (washed)	15.4	16.2	13.5	16.2	16.3	16.8	14.2
3. Head value, calculated	42.7	47.8	43.8	42.4	44.0	43.6	41.9
Effluent after 2-min. wash	0.20	11.89	9.23	12.18	12.03	11.88	11.73
10-min. wash	0.25	.....	.....	.....	.....	.....	.....
20-min. wash	0.11	.....	.....	.....	.....	.....	.....
30-min. wash	0.09	0.40	0.44	0.50	0.67	0.74	.....
45-min. wash	.....	0.20	0.24	0.28	0.39	0.35	.....
60-min. wash	.....	0.18	0.20	0.26	0.26	0.32	0.40
75-min. wash	.....	.....	.....	.....	.....	.....	0.30
90-min. wash	.....	.....	.....	.....	.....	.....	0.25
Wash solution assay	0.03	0.09	0.13	0.12	0.03	0.02	0.06
Filter tailing assays, per ton							
1. Undissolved gold	7.2	7.8	7.1	8.1	8.6	7.8	7.9
2. Dissolved gold	0.48	1.15	0.96	0.14	0.25	0.38	0.70
Gold solution recovery, %	98.5	96.5	96.8	99.5	99.1	98.7	97.5
Dissolution in filter, %	53.2	51.8	47.3	50.0	47.2	53.6	44.4

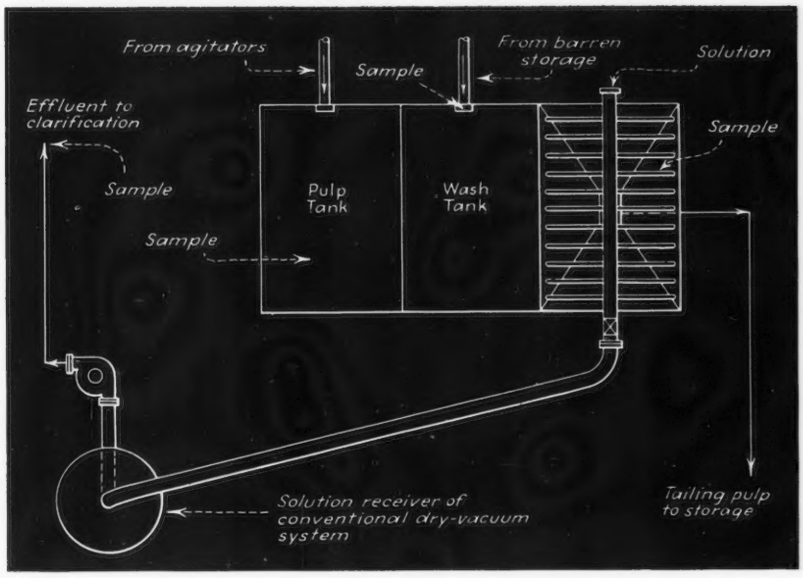


Fig. 3 . . . Plan of a Moore-type filter installation showing the sampling points

this was sampled on every cycle. Samples of effluent were taken at fixed times during the washing cycle as detailed in Table IV.

The repulper discharge was too thin for sampling purposes and the tailing sample was cut from the leaves instead. To avoid possible differences in the condition of individual leaves, this sample was taken for the test from the same spot on the same leaf each time. All pulp samples were "fixed" with permanganate. This routine was worked out as a preliminary, and finally one batch of cyanided calcine was selected at random for a complete test, the data of which are listed in Table IV. The caking period was the only induced variable in the test.

As was to be expected the value of the filter effluent at any given time in the washing period varied with the thickness of the cake. However, the dissolved losses obtained from washing thin cakes were abnormally high. This was due to the formation of cracks in these cakes during the transfer of the leaves from the pulp tank to the washing compartment of the filter. The wash solution was not fully effective under such conditions, due to channeling through these cracks. At a caking time of 7 min., trouble with cracking ceased, and, as can be seen, the minimum dissolved loss was attained at this point.

The method of discharging the filter cake made it possible to get an accurate moisture sample at the end of each cycle, and the value of the residual moisture was calculated from the dissolved loss in each case. This value was higher in every instance than the value of the final effluent, which shows, at least in this case, that it is impossible to estimate dissolved gold losses from effluent assays. The point is of interest because this is a common method of calculating dissolved loss in batch filtration. It also shows that washing time alone is not the only variable involved in attaining low dissolved losses with this type of equipment.

The amount of gold dissolved in the filtration step was unusual, and some additional tests were made to determine when and how the reaction occurred. The violent agitation from the air in the pulp compartment seemed to explain the condition, but careful sampling of the pulp here proved that the extra aëration at this point had no effect. In Table IV it will be noted that the first effluents during the washing period, with caking periods of 7 minutes and over, are higher in value than the corresponding filter-feed solutions. This indicates that secondary dissolution began as soon as the leaves were lowered into the wash solution. Apparently, with caking periods of less than 7 minutes the rate of wash solution displacement was so rapid that the effect of the extra dissolution was masked by dilution.

Two-Stage Filtration—The effect of washing and change of solution on the undissolved gold content of the filter feed offered possibilities for improving recovery, and one complete batch of calcine was filtered and washed twice to see if the value of the final tailing could be lowered in this manner. The cake from the first stage of filtering was repulped in barren solution and reagitated for a short period to accomplish this. The procedure did not lower the amount of undissolved gold in the second filtering stage, which proved that the first change of solution was sufficient to remove the available gold.

This phenomenon is interesting, and, although it has been mentioned previously in the literature, the real reason has never been discovered. In this instance the cyanide concentration of the filter-feed solution and the barren wash solution were practically the same, about 2.50 lb. KCN per ton. If Elsner's equation represents the true mechanics of the dissolving reaction, it would be logical to assume that the wash solution introduced additional oxygen to a system already in equilibrium with respect to this element. In this instance the ratio of wash solution to original feed solution was about 8 to 1.

General—Both of the operations just described are examples which illustrate the danger of overestimating the washing capacity of filters either in cyanidation operation or in plant design. In the first instance three counter-current thickeners preceded the filters, and whenever the ore settled well enough to permit using a proper wash in the tanks, dissolved losses as low as 0.03 dwt. per ton were attained.

In the second instance the choice of a Moore-type filter was the best to meet the operating conditions. It can be seen, however, that considerable gold loss would have occurred by using the wrong caking period in spite of the apparent high washing capacity.

The primary object of the article has been to illustrate the importance of careful sampling, and the performance of each plant was well suited to the purpose. Obviously, neither is an example of the best practice. A point made evident is the need for a reliable laboratory technique for determining the washing requirement for unusual ores which could be correlated with the performance characteristics of various types of filtration equipment.

▼ ▼ ▼

A Makeshift Ore Car

CHARLES LABBE, Johnnie, Nev., sends in the accompanying photo of an ore car ingeniously made from a hoisting bucket. The upper apron shown, he says, must have served the purpose of drawing from a chute or to facilitate dumping. The handle intended for lifting can be seen near the bottom.

This odd car is now the property of the Pacific Coast Borax Co., at Death Valley, Calif.

A *quimbalete* improvised by a native workman using a roughly shaped stone and a handle. The crushing effected with it is the first step in the ore reduction

Concentrating Tungsten Ore by Hand in Bolivia

Crude methods account for much of the current output

H. L. Dotson
Casilla 674
La Paz, Bolivia

APPROXIMATELY HALF of Bolivia's output of tungsten concentrates is produced by crude hand-concentration methods used by the native miners. The ore to be so treated is hand-sorted at the mine with the production of some high-grade *guia*, if its grade permits. The larger pieces are broken with single-jack hammers preparatory to grinding by the *quimbalete*.

The *quimbalete*, as generally used, is a half-round shell of sheet iron, with steel wearing plates bolted to its periphery or crushing surface, and provided with a handle that permits two men to operate it. It is hollow, so that it may be filled with stones to vary its weight according to the crushing to be done. This is accomplished by placing the ore upon a hard, flat surface, such as an iron plate or stone floor, and rocking the *quimbalete* with a peculiar movement until the ore is crushed to required fineness. The Indian in the accompanying picture has improvised one of these grinding devices by wiring a handle to a stone which he has cut to the required shape.

After being crushed, the ore is sized by screening. This is usually done with water diverted from a small stream into boxes containing fixed screens. Women shovel the crushed ore into the incoming stream, which carries it to the screens. The fines are washed through and the coarse material accumulates on the screen and from time to time is piled to one side until it can be taken to the *maratates*. The fines passing the screens flow, by launder, to small buddles, where they are brought up to the grade desired, perhaps by several re-treatments. The number of screen sizes made varies considerably. In an elaborate set-up there will be about six, ranging from 1 mm. to 10 or possibly 12 mm.

The oversize from the fixed screens goes to the *maratates* previously mentioned. These are movable sieve jigs. All sizes are jigged on a screen of smaller size, so that all products are made on the screen itself, with nothing passing through. Such jigging is necessarily a batch operation, and the jig must, at intervals, be emptied by hand. The lighter material which is on top is discarded, and the middling, or next layer, which has accumulated on top of the concentrate, contains some interlocked mineral, and is returned for retreatment.

After being dried, all the coarse concentrate made is hand-picked, by women, to lower the content of sulphur and arsenic if these are present. Occasionally the concentrates are burned or floated to remove the arsenic and sulphur, but this is the exception rather than the rule, the natives preferring to take a lower price for their product rather than go to the expense and trouble of further treatment. Needless to say, the production of a concentrate high enough in grade to be readily salable is of primary importance, and consequently losses are extremely high.

After crushing comes the screening on fixed screens, shown at the left, into which the crushed ore is shoveled

The *maratates*, or crude hand jigs, seen above, receive the oversize from the fixed screens

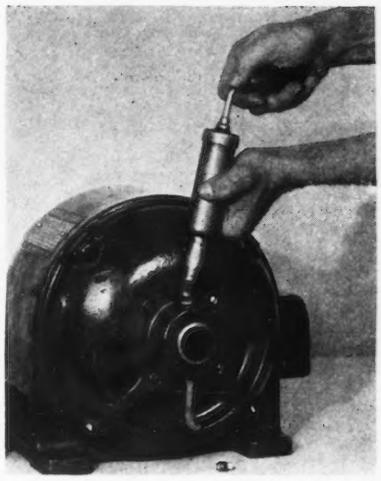
MINE, SHOP, AND PLANT

Maintenance Essential to Production

NEVER UNIMPORTANT, maintenance is a vital function now when equipment and replacement parts are difficult to obtain. Care in the operation of machines and use of tools is well matched by careful planning, as well as by skill and ingenuity in shop and repair departments. Rarely have the latter had a better chance than now to rise to an emergency. At times like these they occupy key positions.

The electrical department of the mine or plant bids for first consideration. When power fails, production stops. Definite maintenance programs are being urged by manufacturers. C. W. Fick, General Electric engineer, outlined one recently before a maintenance group. Their job, he said, was to prevent interruptions in electrical service or to hold them to a minimum, and to plan for bigger loads. Make a list of the electrical equipment in the plant and keep it up to date, he advised, accounting for every motor, control box, transformer, circuit breaker, and cable, in terms of capacity and size. Next, set up a regular schedule of inspection before failures start to happen. Thus if increased output is wanted, what it means to each machine will be known beforehand, so that plans can be made accordingly.

Motors should not have to squeal for lack of oil, or smoke from overload, before their condition is checked to see what can be done about it. The oil in transformers and circuit breakers is expected to serve as an insulating, cooling, or arc-quenching medium. However, it can deteriorate gradually



so that these characteristics are impaired. Breakdown has more than once been due to the oil's dielectric strength not being what it should have been, or failure to maintain its level. Such accidents are sometimes caused by lack of attention by the maintenance man and could have been prevented by a regular inspection schedule.

When motor bearings fail for want of oil, and with the heavier and higher speed machines, the results can extend beyond mere replacement. Sufficient heat may be generated to spring the shaft, or rotor may rub on stator, damaging the laminations, with consequent expensive repairs. Moreover, it is highly necessary to prevent bearing failures because of scarcity of metals. Copper, tin, and antimony, which enter into babbitt, are on the commodity critical list.

Improper brush pressure can result in flashovers of commutators, or arching at collector rings. It is easy to keep pressure at recommended values.

In many cases the wire and cable are being called upon to carry excessive loads. The cables themselves may not show distress, but may have been figured for a certain voltage drop at normal currents, and when those currents are much exceeded the voltage delivered may be insufficient. A 10 percent voltage drop results in a 19 percent loss of torque in an induction motor. This is reflected in a loss of output.

Some failures will occur and should be planned for. Experience and a careful check on loadings will indicate possible danger points. Best procedure is to have spare parts available; if possible a spare machine; and to know where each type of apparatus can be best repaired so that no time will be lost in locating a suitable shop. This is good information to have on the card record of each machine.

Where a new machine must be added it is often possible simply to extend an existing cable run without overloading it or causing an excessive voltage drop. This should be done intelligently, knowing both the cable's capacity and the load it will have to carry.

Major plant extensions will require entirely new feeders, and in such cases specialists should be consulted. Incorrect methods of supplying power to new plant extensions cost excessively and waste materials.

A real motor-maintenance program begins with selection, according to O. F. Vea, who is with the same company as Mr. Fick. Motors must be chosen that are properly rated and protected for their work. This selection involves a study of requirements, such as continuous or intermittent duty, starting, torque, speed regulation, and the like. Tables I and II show characteristics

Table I—Characteristics and Applications of Polyphase A-c Motors

Polyphase Type	*Ratings Hp.*	*Speed Regulation*	*Speed Control*	*Starting Torque*	*Pull-out Torque*	*Applications*
General-purpose squirel-cage	0.5 to 200 hp.	Drops about 3% for large to 5% for small sizes	None, except multi-speed types, designed for 2 to 4 fixed speeds	200% of full-load for 2-pole to 105% for 16-pole desgins	200% of full-load	Constant-speed service where starting torque is not excessive. Fans, blowers, rotary compressors, centrifugal pumps, wood-working machines, machine tools, line shafts
Full-voltage starting, high starting torque, low starting current, squirrel cage	3 to 150 hp.	Drops about 3% for large to 6% for small sizes	None, except multi-speed types, designed for 2 to 4 fixed speeds	250% of full-load for high-speed to 200% for low-speed designs	200% of full-load	Constant-speed service where fairly high starting torque is required at infrequent intervals with starting current of about 400% full load. Reciprocating pumps and compressors, conveyors, crushers, pulverizers, agitators, etc.
Full-voltage starting, high-starting torque, high-slip, squirrel-cage	0.5 to 150 hp.	Drops about 7 to 12% from no load to full load	None, except multi-speed types, designed for 2 to 4 fixed speeds	300 to 315% of full load, depending upon speed and rotor resistance	300%. This motor will usually not stall until loaded to its maximum torque, which occurs at standstill	Constant-speed service and high starting torque if starting not too frequent, and for taking high-peak loads with or without flywheels. Punch presses, die stamping, shears, bulldozers, bailers, hoists, cranes, elevators, etc.
Wound-rotor, external-resistance starting	0.5 to several thousand	With rotor rings short-circuited, drops about 3% for large to 5% for small sizes	Speed can be reduced to 50% of normal by rotor resistance. Speed varies inversely as the load	Up to 300% depending upon external resistance in rotor circuit and how distributed	200% when rotor slip rings are short circuited	Where high starting torque with low-starting current or where limited speed control is required. Fans, centrifugal and plunger pumps, compressors, conveyors, hoists, cranes, ball mills, gate hoists, etc.
Synchronous	25 to several thousand	Constant	None, except special motors designed for 2 fixed speeds	40% for slow-speed to 160% for medium speed 80% pf designs. Special high-torque designs	Unity-pf motors 170%; 80% = pf motors 225%. Special designs up to 300%	For constant-speed service, direct connection to slow-speed machines and where power-factor correction is required.

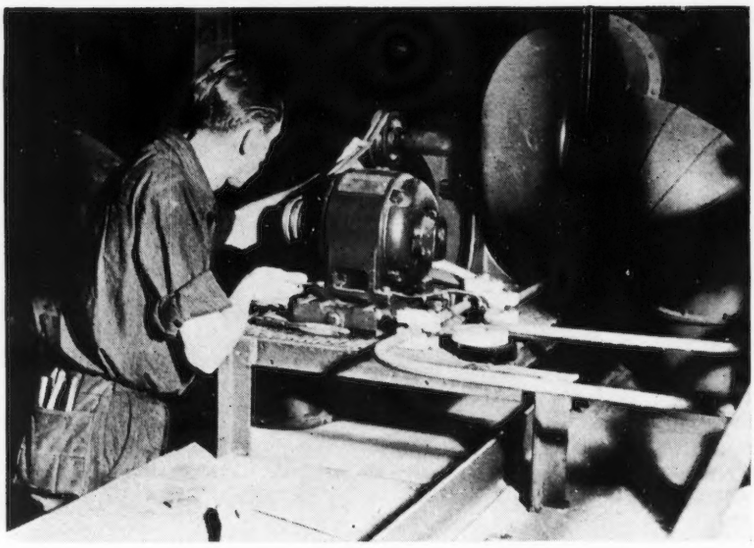
and applications of standard a.c. and d.c. motors, respectively. Table II appears at the bottom of this page.

The environment in which the motor is to operate should also be considered, as it determines whether an open motor or some form of inclosed motor should be used, and how it should be located with respect to the driven load.

Next to be considered is installation. To have a long, trouble-free life a motor should be accessible for inspection and repairs. It should be in a place free from adverse conditions unless built in a protecting inclosure. It should have ample ventilation.

A standard motor should not be installed where the ambient temperature or normal temperature rise is more than 40 deg. C. It should be on a solid foundation free from vibration. If direct-connected or belted, it should be properly aligned, which should permit rotor end-play within reasonable limits.

All these factors must be considered if inspection and maintenance are not to be discouragingly difficult.



Install the motor in such way that it can be reached easily for making inspection and repairs

Hands Across the Coal Pile

A LITTLE TIP from the coal man is as good as any other, if it will save the metal miner money. At times it looks as if the two great branches of the mining industry had made a compact to ignore each other, even with so much in common, technology as well as labor matters. There are exceptions—perhaps a new day is breaking—as recently when a company in New Mexico adopted rubber-tired shuttle cars underground for hauling potash from working face to shaft, a leaf taken right out of the coal miner's book. And here's the tip, in line with the talk preceding on maintenance and motors: "Armature repairs are a barometer to increasing maintenance costs"—this from an engineer who serves a company that operates 17 mines and which spent $39,000 last year on such repairs in a single one of its divisions. When armatures give that much trouble, the company finds other repair costs are also high. He has the facts because records of repair costs for every motor since it was installed have been kept for 22 years.

From still another engineer comes this: "Price is no consideration in buying. Our need is efficiency and low maintenance cost. When the cost of maintenance rises suddenly on a machine we find that it soon has to be laid up for repairs. I've seen it cost as much as $5,000 for a mechanical or electrical breakdown and it may run higher when you have 200 men underground."

Hard-Facing Magic—It Overcomes Abrasion

WELDING AND CUTTING are as superior to the methods that preceded them for accomplishing the things they do as the mazda lamp has been to kerosene. Their enormous value in fabrication and maintenance can be appreciated only by those who can recall when they were dependent on the older technique of rivet, bolt, and hacksaw. At least one of their accomplishments, hard facing, had formerly no counterpart. This welding process for coating or edging wearing parts with wear-resistant metal, either when new to prolong their life or when worn to build them up again, has doubtless repaid every user the cost of installing it many times. Essentially it is an aid in maintenance and will prove its value just now in getting maximum life out of equipment.

Choice of the proper hard-facing material for a specific application depends on the conditions of abrasion and impact, or the combination of these that may be met. In making a selection the manufacturer should be consulted. In the following applications Haserome rod was used. This is an iron-base rod containing chromium and manganese. It is a work-harden-

Table II—Characteristics* and Applications of D-c Motors, 1 to 300 Hp.

Type	Starting Duty	Maximum Momentary Running Torque	Speed Regulation	Speed Control†	Applications
Shunt-wound, constant-speed	Medium starting torque. Varies with voltage supplied to armature, and is limited by starting resistor to 125 to 200 percent full-load torque	125 to 200 percent. Limited by commutation	8 to 12 percent	Basic speed to 200 percent basic speed by by field control	Drives where starting requirements are not severe. Use constant-speed or adjustable-speed, depending on speed required. Centrifugal pumps, fans, blowers, conveyors, elevators, wood-and metal-working machines
Shuntwound, adjustable-speed			10 to 20 percent, increases with weak fields	Basic speed to 600 percent basic speed (lower for some ratings) by field control	
Compound-wound, constant-speed	Heavy starting torque. Limited by starting resistor to 130 to 260 percent of full-load torque	130 to 260 percent. Limited by commutation	Standard compounding 25 percent. Depends on amount of series winding	Basic speed to 125 percent basic speed by field control	Drives requiring high starting torque and fairly constant speed. Pulsating loads. Shears, bending rolls, plunger pumps, conveyor crushers, etc.
Series-wound, varying-speed	Very heavy starting torque. Limited to 300 percent to 350 percent full-load torque	300 to 350 percent. Limited by commutation	Very high. Infinite no-load speed	From zero to maximum speed, depending on control and load	Drives where very high starting torque is required and speed can be regulated. Cranes, hoists, gates, bridges, car dumpers, etc.

*Table shows average values for standard motors.
†Minimum speed below basic speed by armature control limited by heating.

Motor connections should be made tight enough to keep them from loosening up under the vibration of the equipment

ing alloy and attains its most wear-resistant conditions after undergoing impact. It can be forged or ground but not economically machined.

One company in Utah built up a "two-piece" crusher mantle, using 125 lb. of rod. After almost a year's service, the mantle was still in perfect condition. The saving over the cost of a new one was about 60 percent.

At a mine in California the average life of a mantle crushing copper pyrites was approximately six months, at the end of which time the metal, 2½ in. thick at the start, was practically worn through. The worn surface was built up with 90 lb. of rod, requiring 25 hr. of welding time. Total cost of rebuilding, including overhead, was slightly more than 25 percent of the cost of a new mantle. At the end of four months, after crushing 28,000 tons of copper pyrites, this part showed but ⅝ in. of wear. Three more mantles have been reclaimed. Their average life is estimated at twice that of the ordinary ones.

At a Michigan mine, a 34-ton gyratory mantle was recently rebuilt. Although more than 1,400 cu.in. of metal had worn away, it was successfully rebuilt with 250 lb. of manganese steel and hard-faced with 200 lb. of rod in 104 hr. total welding time.

In Minnesota a mining company found salvaging of worn crusher plates decidedly economical. The jaw ribs were built up a layer at a time until a ¼-in. thickness had been obtained. Rebuilding to original size required 200 lb. of rod. Results show that this hard facing has more than doubled the life of ordinary jaws.

At a Southwest copper mine no spare jaws were available, so the plates were built up in place to reduce the shutdown time. The rod deposit was staggered so that the welding heat was not concentrated in one part of the plate. A worn rib was not completely built up in one operation, but one layer was applied and then another laid down on another rib some distance away. After this application, at least twice as much tonnage was crushed per pound of metal worn off the plates.

Another method has been devised for applying rod electrically to large jaw crusher plates in place, this in the Minnesota Iron Country. A copper templet is propped up against the bottom of the plate to act as a shelf for the deposit and to outline the desired shape. The operator is swung down in a cradle and beads of rod are welded on the worn section against the copper plate. A small amount of welding is done on each corrugation in turn to avoid producing too much heat in one spot. This gave good results without warping or loosening the plate.

A New Mexico copper company has standardized on hard-faced liners for coal pulverizers. Total cost for rebuilding and hard-facing 54 badly worn liners was $420.93, or $7.79 each —less than one-third the cost of a new one.

Building up worn ball-mill liner plates has been economical at a Colorado mine. In general practice, ordinary plates are replaced when worn down 1½ in. in thickness because often at that stage some sections have been reduced in spots to ½-in. thickness. Average life is about three months. These plates were hard-faced in place by attaching scrap steel to the worn faces and building the surface up with the rod. Depending on the amount of steel used, each of the 18 plates took 30 to 100 lb. of rod.

A Southwest smelter hard-faced its matte ladles which are subject to considerable wear and corrosion from hot metal. Holes are often burned through the sides and cracks develop because of internal stresses due to expansion and contraction. Welding was used to repair the damage, but the metal deposited in the fracture was eaten away by matte, and, when the burnt spots had been repaired, the patches were literally torn out after the ladles had been put back into service. This problem was overcome by making patches of deposited rod. These stand up even longer than the metal of the ladle.

Make It Last

RUBBER IS VITAL and the supply is insufficient. On this point there is no doubt. Before the situation improves, it is likely to be much worse. In any case those who are smart will play it safe and get the most out of the rubber goods they have in service and in the warehouse. Replacements will be hard to get.

Substitutes there are for rubber, of course. Much is heard of buna, butadiene, and whatnot, to say nothing of certain cousins of the rubber plant that may be made to grow at home in the United States. In time the synthetic kind of rubber will be available and in quantities that will steadily increase. But that's a long way off. Meanwhile, the air and water hose at the face will last longer if treated kindly when fitting couplings, if not allowed to kink, and if hauled to safety when blasting so that it won't be shot upon. Likewise the belting in mine and mill, whether conveyor, elevator, or transmission, will have greater life expectancy if nursed a bit. The conveyor has been making rapid progress underground, and at one Iron Country installation it has been found to pay to vulcanize, right on the job, small cuts and breaks in the rubber surface before the damage spreads. And so with other uses. A distinct technique for the care and handling of rubber goods to make them last has been developed, and competent advice is freely to be had. Today the manufacturer seeks the cooperation of the users of his equipment to secure for it the longest possible life. Of this more hereafter.

The Ersatz Corner

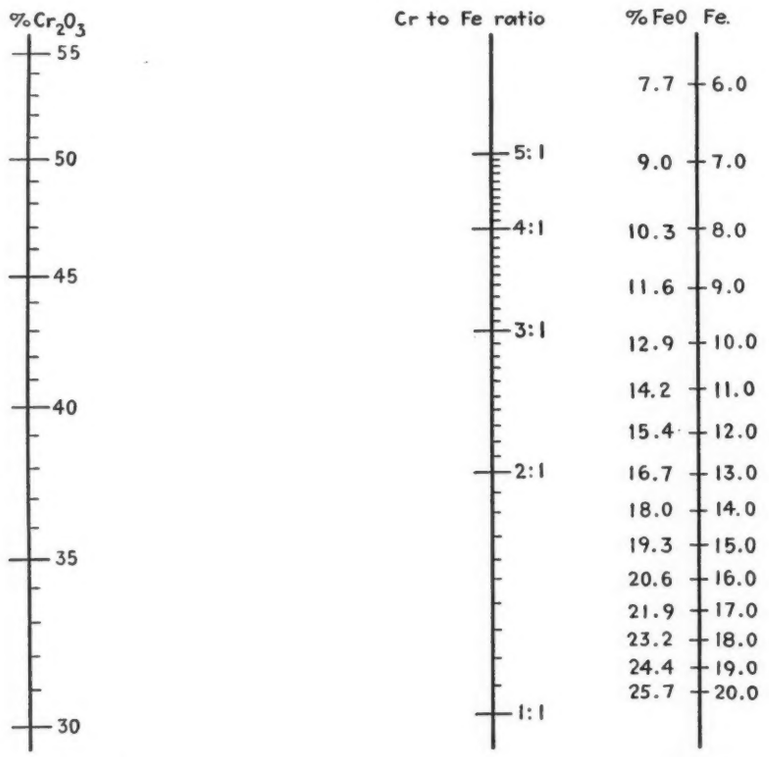
► Save zinc for war purposes by using black enamelled conduit instead of the zinc-coated stuff for protecting wiring systems, except where the white conduit is absolutely necessary. The enamelled variety is time-tested and has an excellent performance record where carefully handled and installed.

► If bronze trolley wheels are hard to get, replace them with steel sliders, suggests one maintenance engineer (manufacturer's name on request). They follow the wire and with less arcing. Lubrication of the wire is important. This engineer applies graphite mixed with carbon tetrachloride once a month five or six hours before using. It dries in places, burnishes the wire.

USEFUL OPERATING IDEAS

Computing a Chromium-to-Iron Ratio

Ray C. Treasher *Field Geologist*
R. G. Bassett *Analyst*
Department of Geology and Mineral Industries
Grants Pass, Oregon



Nomographic chart for determination of chrome-to-iron ratios from assay data

THE SALE PRICE of chromite depends not only on the chromic oxide content but frequently on the chromium-iron ratio. For example, an ore that assays 48 percent chromic oxide (Cr_2O_3) and has a chromium-iron ratio (Cr:Fe) of 3:1, is classed as metallurgical ore and commands a premium price. However, the chromium-iron ratio (Cr:Fe) of 3:1 does not mean a chromic oxide (Cr_2O_3) to iron oxide (FeO) ratio of 3:1, as is sometimes assumed. It means a ratio of metallic chromium to metallic iron of 3:1. Assays frequently report in terms of oxides, so if the Cr:Fe ratio is desired, certain computations are necessary.

If the assay report shows that both chromium and iron are reported as oxides and the Cr:Fe is desired, the formulas presented in the following are used:

(1) Chrome part of Cr:Fe = $\dfrac{(Cr_2O_3 \text{ in percent})\ (0.8802)}{\text{FeO in percent}}$

Example: Assay report shows Cr_2O_3 50 percent
FeO 20 percent
What is the Cr:Fe ratio?
Substituting in (1) given above:
Chrome part of Cr:Fe = $\dfrac{(50)\ (0.8802)}{20} = 2.2$

Therefore the Cr:Fe is 2.2:1

If the assay report shows chrome as Cr_2O_3 and the iron as Fe (metallic), the following formula will serve:

(2) Chrome part of Cr:Fe = $\dfrac{(Cr_2O_3 \text{ in percent})\ (0.6842)}{\text{Fe in percent}}$

Example: Assay report shows Cr_2O_3 50 percent
Fe (metallic) 20 percent
What is the Cr:Fe ratio?
Substituting in (2) given above
Chrome part of Cr:Fe = $\dfrac{(50)\ (0.6842)}{20} = 1.7105$

Therefore, the Cr:Fe is 1.7105:1

For those who are interested, the derivation of (1) is given: Cr_2O_3, mathematically, is reduced to metallic chrome by multiplying the value for Cr_2O_3 by the proportion of Cr in Cr_2O_3.

(3) $(Cr_2O_3)\ (0.6842) = Cr$

The same applied to iron in FeO:

(4) $(FeO)\ (0.7773) = Fe$

In determining the Cr:Fe, the values of Cr_2O_3 and FeO must be changed to Cr and Fe as shown in (3) and (4). This is done as shown in equation (5).

(5) Chrome part of Cr:Fe = $\dfrac{(Cr_2O_3 \text{ in percent})\ (0.6842)}{(FeO \text{ in percent})\ (0.7773)}$

The equation (5) is further simplified by dividing 0.6842 by 0.7773 to obtain 0.8802 as in formula (1).

The derivation of (2) is similar except that Fe (metallic) is used instead of FeO and it is not necessary to use 0.7773 in the denominator.

The accompanying nomographic chart for the determination of the chrome-to-iron ratio is convenient for rapid estimations. A straight-edge placed on the desired points of the chrome and iron lines will intersect the ratio line at the proper value. For example: A straight line from the 50 percent mark on the chrome scale to the 11 percent mark on the iron scale crosses the ratio marked 3.1 to 1, and the problem is solved.

▲

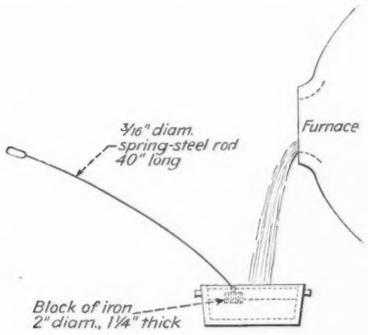
Cactus Juice Settles Slime

A NOVEL REAGENT for hastening flocculation and settlement of very fine slime can be prepared from the cactus plant, according to Ernst Phillip, mining engineer, of Oruro, Bolivia. The plants are crushed and digested with hot water, and the resulting solution is decanted. In the batch process of slime treatment Mr. Phillip uses about 10 gal. of juice for approximately 200 gal. of slime containing 50 to 40 percent solids.

For a continuous process, a drum of juice would be placed over the launder in which the slimes are flowing, and the valve adjusted to allow the required quantity to mix with the slime. Inasmuch as the procedure is empirical, a few trials would have to be made to determine the strength of the infusion and the quantity to be used.

Pouring Bullion

WHEN POURING BULLION a quantity of slag normally runs into the molds along with the metal and prevents the operator from judging the size of bars

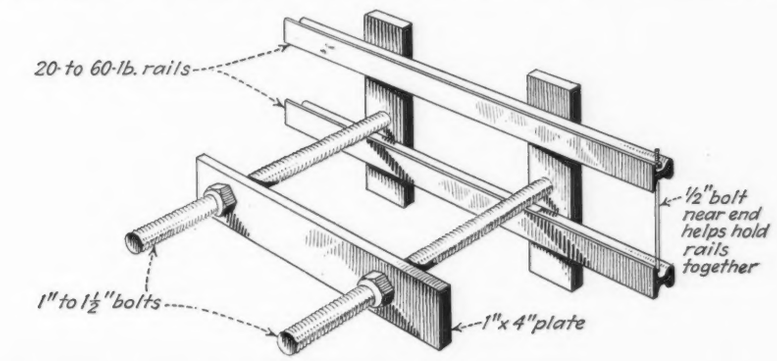


being poured, writes R. D. Lord, mill superintendent of Preston East Dome Mines, South Porcupine, Ont. Mr. Lord sends in the accompanying drawing of a tool which may be used as an indicator of the size of the bars. This is simply a block of iron on a flexible steel rod. The iron, having a density intermediate between that of the slag and the bullion, floats on the latter, and indicates the size of the bars successfully.

▲

A Strong Wheel Puller

WHEN A COUPLING or pinion has to be taken off the end of a shaft and is so tight that a jack is not strong enough or there is a risk of breaking the wheel-puller, the following is recommended by Charles Labbe, Johnnie, Nev. Two short pieces of rail (20- to 60-lb., according to the work), on the back of the pinion or coupling, two strong washers, and two 1- to 1½-in. rods or bolts with a strong plate at the end of the shaft are required. If the pinion or coupling is flush with the end of the shaft, the customary short piece of iron or nut is to be placed at the end. The bolts can be tightened as strongly as possible. The plate on the front or the rails can be hammered on to help starting. The advantage of using the rails is that they will lie flat and will not bend. For strong rough work, this type of puller will outlast any other.



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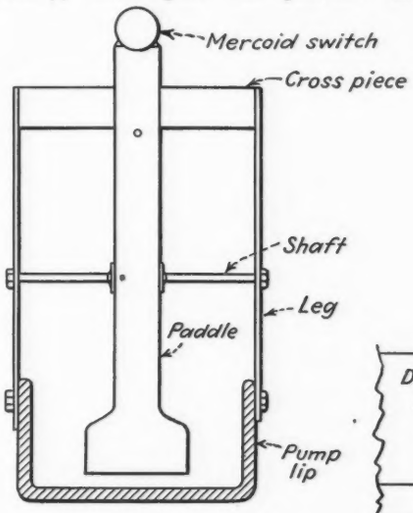
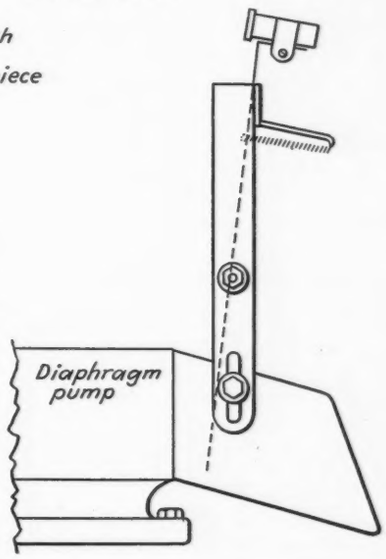
Underflow Indicator

THE NECESSITY which gave rise to the design of the device here described was that of holding thickened tailings on a hillside. Obviously, the higher the percent solids in the tailings thickener underflow, the easier the task; hence the importance of maintaining a thick diaphragm pump discharge.

The thickener was so located that it was inconvenient for the mill men to maintain a close watch over it; moreover, a thinning out or a drop in percent solids in the pulp would result in the sluicing away of accumulated tailings, and a thickening or an increase in percent solids slightly higher than that desired would result in clogged pipes from the thickener to the pump. An indicator was therefore devised which registered the approximate character of the pulp at some conspicuous point in the mill.





The indicator consists of an inverted U-shaped standard bolted to the sides of the diaphragm-pump lip. The bolt holes are slotted for a reason to be explained later. About halfway up the legs of the standard a shaft of ¼-in. rod is mounted. Floating on it is a bushing and paddle of galvanized iron to which the bushing has been soldered. The top of the paddle is held back against the crosspiece of the standard by means of a light spring, one end of which is fastened to the paddle, the other to a hook on the end of a short piece of ⅛-in. rod welded to the crosspiece. About an inch of the top end of the paddle is bent over at right angles and to it is clamped a mercoid switch.

One leg of the mercoid is connected to a 110-v. line, the other to one side of a 50-w. bulb located at some prominent place in the mill, and the other side of this bulb to the other side of the 110-v. line.

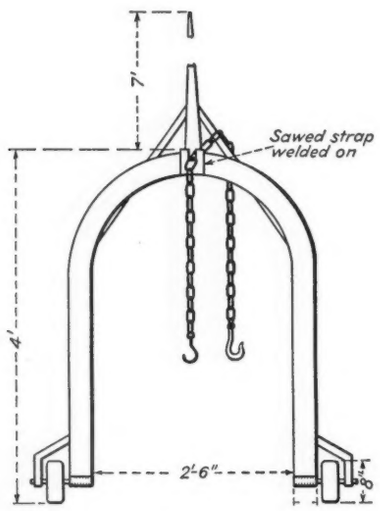
The apparatus should be placed in operation while the pump is discharging pulp of the proper percent solids, say 60. At this density, flow from the pump is intermittent and consists of a regular series of waves or pulsations. By means of the slotted holes in the legs of the device the apparatus can be lowered to a point at which the lower end of the paddle is carried backwards by each pulsation, thus closing the mercoid switch and lighting the bulb in the mill. It should not be lowered more than enough to produce a quick flash of light which in the future will indicate proper conditions. The spring pulls the paddle back at the top after each wave, thus opening the circuit. Another way of securing a quick flash is to adjust the tension on this spring. As long as the pulp density remains constant the bulb will give a short flash of light for every stroke of the pump. Should, however,

the density fall off, the volume will increase and the periods of illumination last longer, until at a low percent solids the flow will be almost continuous and the light will stay on. Conversely, should the density build up, the volume will fall off and the pulsations will become weaker and more laggard; meanwhile, the light will have been skipping a flash now and then, and will gradually miss more, until, should the condition not be remedied, it will finally stay off.

If desired, the mercoid may be turned end for end, thus reversing the light signals. If this type of switch is not available, two carbon contacts can be arranged, one on the paddle and the other on the crosspiece of the standard, so that they open and close the circuit. A condenser should be placed across them to reduce the arc and consequent burning of the contacts.

It is important that the apparatus be mounted as close to the pump as possible, as the waves discharged by the pump rapidly fade away into a more or less steady stream.

Shop Truck



LUGGING MOTORS, speed reducers, large valves, and like equipment can be a trying chore unless some device is used to take the "back break" out of the job. The sketch shows a simple, rugged, versatile truck that comes in handy, according to P. C. Ziemke, Milwaukee, Wis. It consists of a horseshoe-shaped frame developed by the blacksmith on his steam hammer from ½ x 4-in. stock. The outboard axle supports are hand-forged and arc-welded to the main frame, and are then drilled and reamed for brass bushings and machined pins. The wheels can be all-metal, if such are available. We have discovered that the rubber-tired wheel gets over rougher going and with less noise and effort. A 6-ft. length of ⅜-in. chain equipped with a round hook on one end and a grab hook on the other to facilitate making almost any type of hitch is passed over a sawed notch in the apex of the horseshoe frame. The handle is fashioned from 1¼-in. standard pipe and is supported at two points by braces made of the same material, also welded on.

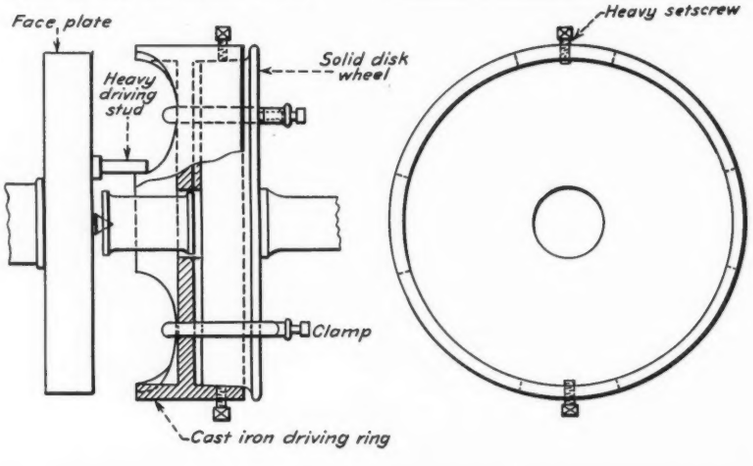
In practice, the round hook is usually hooked into the ring of the motor or the chain brought once around to suspend an armature. One can appreciate the great leverage one man can exert by reason of the long handle in lifting any weight that can be swung free of the floor.

A Drive Ring for Rectifying Treads

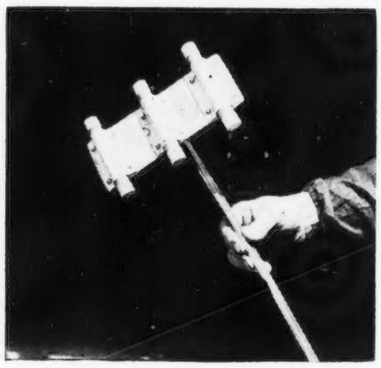
A TASK frequently carried out at the mine or smelter machine shop is rectifying in the lathe the treads of wheels on the different cars operating on the surface or underground. Small-diameter wheels in general offer little or no difficulty, but this is not the case when handling wheels used on 30-ton or heavier cars. Here, a special lathe set-up is required to insure safe and rapid rectification of the treads. Of particular importance is the use of an efficient driving device to contact with the driving stud of the face plate. Such a unit should be of sturdy construction, easily adjustable, and the portion making contact with the drive stud as close as possible to the face plate of the lathe to prevent shattering.

A device that meets these requirements was recently developed at the machine shop of a large Southwestern copper smelter, the details of which are shown in the accompanying illustration. It essentially consists of a heavy, cast-iron ring, with a tapered recess at one end to accommodate the tread part of the car wheel and four fingers or prongs at the other end to contact the drive stud of the face plate. The ring is held securely to the car wheel by two steel clamps, and two heavy setscrews on the periphery of the ring prevent slippage. As the device can remain on the lathe bed, relatively little time is lost when it is changed from one wheel to another.

Detail of ring and method of use



Fuse Protection Of Pump Motor



"WE HAVE a motor-driven pump, working against 500-lb. pressure," writes John Broatch, master mechanic for Bayonne Consolidated Mines, Bayonne, B. C. "It does not run continuously, and we have had considerable trouble with the fuses. The motor is protected by a relay switch, etc., but on the first surge of power the fuses are very likely to go. To overcome this trouble I have temporarily doubled up on the fuses in the fuse box. The flat bar or handle has a hole in it which slips onto a pin and acts as a fulcrum. The weight of the fuses fixed to a piece of three-ply wood is sufficient to throw them back out of contact with the regular fuses in the box, so that the operator has to hold them in contact when pushing the button on the starting switch. On releasing the handle the motor is again protected with the correct fuses. Since installing this we have not blown one fuse."

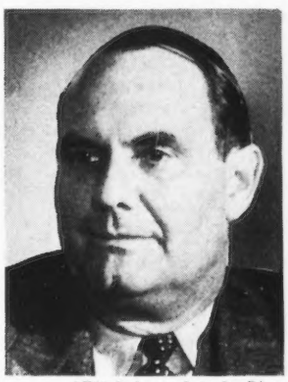
PERSONAL ITEMS

Alexander I. Henderson, new chief of the Materials Division of the War Production Board, is a native of New York City, a graduate of Harvard, and a lawyer by profession. Before going to Washington in 1940 he was a partner in the firm of Cravath, de Gresdorff, Swaine & Wood. Mr. Henderson served as an artillery officer in the first World War. In July of the year noted he joined the old National Defense Advisory Commission under William L. Batt. Though the name of the organization has changed frequently since that year, his work has remained the same—the problem of materials. His position is one of administration. He has a staff of professional technical advisers. In common with Mr. Batt, Henderson is an all-out-for-war man. He has given up his practice and is devoting all of his energies to the nation's service.

National Defense Advisory Commission—Photo by Dixon

ALEXANDER I. HENDERSON

William L. Batt who has been Director of the Materials Division, War Production Board, has resigned from that post. Pressure of many other duties has forced him to withdraw from actual administration of the Materials Division. He will continue to act as chairman of the Requirements Committee of the War Production Board; American member of the Combined Raw Materials Board established by joint action of the President and Prime Minister Churchill last January; Coordinator of the Russian Aid program; and chairman of the U. S.-Canada Coordinating Committee.



OEM Defense photo by Dixon

WILLIAM L. BATT

Ira O. N. Swanson has been advanced by the Oliver Iron Mining Co. from efficiency engineer to assistant superintendent of Eveleth mines. He succeeds **J. S. Wilson,** who resigned.

Robert H. Ramsey has joined the editorial staff of *Engineering and Mining Journal* and will make his headquarters in New York. For the past three years he has been engaged as a metallurgical engineer for Pan-American Engineering Co., Berkeley, Calif. Mr. Ramsey is a native of Wisconsin and a graduate in mining engineering at the University of Wisconsin. As a result of post-graduate research in flotation at Wisconsin and at the Montana School of Mines he was awarded the Master's degree by each institution. Prior to his recent employment with Pan-American, he was superintendent of a flotation mill for Mina el Arco, Baja California, Mexico, and metallurgical engineer for Placer Management, Ltd., at its Colombian properties.

ROBERT H. RAMSEY

George M. Lee has joined the staff of Ventures, Ltd., at Vancouver, B. C.

Grant Mahood recently returned to Vancouver, B. C., after spending a year in British Guiana.

E. "Ted" James has joined the staff of the Con mine, at Yellowknife, N. W. T.

James Melvin has been added to the staff of the Red Rose tungsten mill at Hazelton, B. C.

DR. C. E. NEEDHAM

Dr. C. E. Needham, President of the New Mexico School of Mines, and director of the State Bureau of Mines, resigned his positions in April. Dr. Needham has accepted a position with the Economics and Statistics Branch of U. S. Bureau of Mines in Washington. He holds a Ph.D. degree in geology from Northwestern University. Prior to becoming president of the New Mexico School of Mines, he was on the geological staff of the same institution.

George R. Drysdale, of New York City, has been elected a vice president of the Phelps Dodge Corp.

H. L. Batten, formerly engaged in professional work in New Guinea, has engaged in war work at Ottawa, Canada.

C. Sewell Thomas, consulting mining engineer, Denver, Colo., went to Cuba early in May on professional business.

R. H. Stewart has resigned from the post of consulting engineer for Hedley Mascot Gold Mines, Ltd., at Hedley, B. C.

H. Nolan Macpherson has been named regional representative for the Vancouver area for the Canadian Wartime Bureau of Technical Personnel.

Raymond E. Wimber, mining engineer and geologist, has left the service of the Gilded Age Mining Co., at Ely, Nev., in anticipation of being called into the United States Army.

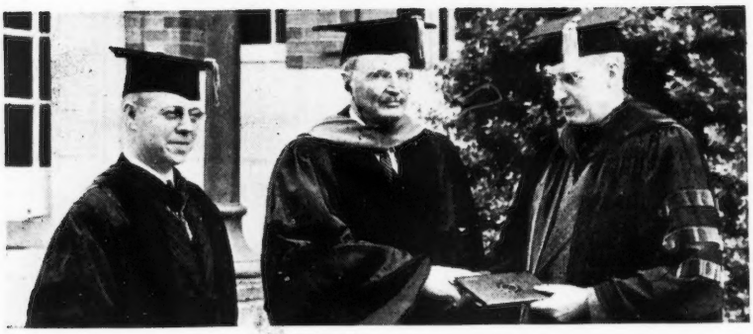
George L. H. Loram has been engaged as consulting engineer by the Volo Mining Co., of Placerville, Calif., to direct the exploration, mining and milling of chrome.

William O. Vanderburg, recently mining engineer with the U. S. Bureau of Mines at Reno, Nev., is acting as foreign minerals specialist for the Bureau in Peru.

E. C. Winsborrow, chief chemist of the car division of the Canadian Car & Foundry Co., Ltd., was on April 27 unanimously chosen as chairman of the Montreal Chapter of the American Society of Metals.

Harold Kingsmill, following a recent meeting of the board of directors of Cerro de Pasco Copper Corp., was elected president of the company, succeeding **Edward H. Clark,** who was elected chairman of the board.

F. D. De Vaney of Rolla, Mo., has joined the Ore Research Department of the Pickands, Mather & Co., with headquarters in Hibbing, Minn. Mr. De



DR. CLINTON H. CRANE, president of the St. Joseph Lead Co., receiving the honorary doctor of engineering degree at the commencement of the Missouri School of Mines and Metallurgy on May 1. Left to right, DR. CURTIS L. WILSON, Dean of the school; DR. CRANE and DR. FREDERICK A. MIDDLEBUSH, president of the university.

Vaney was formerly connected with the U. S. Bureau of Mines at Rolla.

Merrill W. MacAfee, for the past five years in the Los Angeles office of The Dorr Company, has been commissioned a captain in Ordnance. At present he is stationed at Camp Sutton, N. C.

Andrew W. Newberry, mining engineer, is now employed by the Bureau of Mines with headquarters at College Park, Md. He is in the Eastern strategic minerals projects section.

Brenton S. Brown, of Vancouver, has been elected president of Hedley Mascot Gold Mines, Ltd., to succeed **Wendell B. Farris,** who has been elevated to Chief Justice of the Supreme Court of British Columbia.

Jorge Ribadeneira, formerly professor of geology at the Military College, Quito, Equador, S. A., has been appointed director general of the Mining Bureau, succeeding **Enrique Coloma Silva,** resigned.

S. M. Manning returned recently to Vancouver, B. C., from Saudi Arabia, where he had been in charge of the Cradle of Gold mine for Premier Gold Mining Co., Ltd. He has since left for eastern Canada to engage in war work for the Department of National Defence.

Maxwell E. Playford, who resigned the position of assistant general manager of Mount Morgan, Ltd., to join the Department of Munitions, has returned from a visit to the United States of America, Canada, and England on behalf of the Commonwealth Government.

Raymond B. Ladoo is now chief of the mica and graphite branch of the Materials Division of W.P.B. His appointment took effect April 29, 1942. **Howard F. Wierum** is to be the technical consultant and senior commodity specialist.

D. C. Sharpstone has gone to Rhodesia for the United States Government Metals Reserve Co. and the State Department. He will investigate the availability of the country's possible sources of strategic minerals needed by the United States.

J. Malcolm Newman, a director of Mount Morgan, Ltd., and Tableland Tin Dredging, N. L., has been appointed controller of non-ferrous metal production. He is assisted by a committee comprising **Sir Colin Fraser, Dr. H. G. Raggatt, A. J. Keast,** and **M. J. Martin.**

Henry C. Carlisle, consulting engineer of San Francisco, is now chief of production of the tungsten branch of the War Production Board at Washington, D. C. During a part of the summer he will make his headquarters at 315 Montgomery St., San Francisco.

F. S. Turneaure, formerly of the staff of the Oliver Iron Mining Co., is engaged in research work at Harvard University. He is an expert on tin and expects soon to go to Bolivia, where he was formerly associated with Patino Mines & Enterprises.

William E. Kennedy, executive vice president of Anaconda Sales Co., was on May 20 presented with a large globe of the world by the members of his organization in celebration of Mr. Kennedy's 40 years of service with the company.

W. J. Loring has severed his connection with the Madre de Oro Gold Mine, Inc., and disposed of his interest in that company. He is now managing engineer of the Alhambra-Shumway Mines, Inc., and is interested, also, in copper and quicksilver. He can be reached at El Dorado, Calif.

W. R. Welton, formerly supervisor of production for the Oliver Iron Mining Co. in the Virginia-Eveleth district, was recently made assistant superintendent of the Virginia district. **W. F. Pellenz** is the general superintendent of this district, with headquarters in Virginia.

E. J. Fearing, of Hibbing, Minn., was recently made superintendent of the Dunwoody mine in Chisholm, Minn. This mine is operated by Pickands, Mather & Co. Mr. Fearing is also superintendent of the Scranton mine, in Hibbing, and will continue to make his headquarters there.

Alan Kissock, vice president of Climax Molybdenum Co., in charge of that company's plant at Langeloth, Pa., recently resigned. He has been succeeded by **Arthur Linz,** who will take charge of operations at Langeloth and will continue direction of the activities of the company in the chemical field.

Adam A. Boyd, chairman and managing director of Mount Morgan Ltd., has been awarded the medal of the Australasian Institute of Mining and Metallurgy for 1942 in recognition of his outstanding contributions to the advancement of the mining industry in the Commonwealth.

David D. Baker, manager of Western mining operations for U. S. Vanadium Corp., has moved from San Francisco to Salt Lake City, where he will have charge of the chemical refinery to be built this year to treat low-grade tungsten concentrates.

Charles J. Stakel, of Ishpeming, Mich., until recently superintendent of the Cliffs iron mine of the Cleveland-Cliffs Iron Co., has been appointed assistant manager of the company's mining department, a position created a short time ago at the general mining offices of the company at Ishpeming, Mich.

Carl S. Elyer, of Vanadium, N. M., has resigned from his post as superintendent of the Ground Hog lead-zinc-copper mine of the American Smelting & Refining Co., in the central mining district of New Mexico, to engage in consulting mining practice. **Fred V. Richard,** mine foreman at the Ground Hog mine, succeeds Mr. Elyer.

George C. Heikes has been appointed chief of the Zinc Branch, WPB, by Alexander I. Henderson, Director of Materials. He replaces David Uebelacher, resigned. Mr. Heikes is now a resident of Washington and is a government employee. He is a graduate of Lehigh University and has been a geologist and mining engineer for many years, and formerly was with National Lead and Anaconda.

Prof. A. K. Snelgrove, head of the department of geological engineering at the Michigan College of Mining and Technology and member of the Committee on Mining Geology of the A.I.M.E., recently delivered a series of addresses on "Geological Prospecting Criteria," at Ann Arbor, under an exchange lecture arrangement between the Michigan College of Mining and Technology and the University of Michigan.

Dean J. N. Finlayson of the University of British Columbia has been appointed head of a war metals research board to promote development and utilization of British Columbia's strategic metals resources. **R. H. Stewart** represents mining on the board; **W. E. Cockfield,** the Federal Department of Mines and Resources; and **J. F. Walker,** the British Columbia Department of Mines.

E. L. Longmore ("Happy" Longmore), for many years mill superintendent and more lately metallurgist for Hollinger Consolidated Gold Mines, has been appointed general manager of War Time Metal Corp., a Canadian Government non-profit organization, formed, with headquarters in Montreal, to perform emergency work respecting the supply of special emergency metals and services.

C. Carleton Semple, general manager of Compania Minas Matagalpa, plans to visit the United States about July first. He will leave **Paul Rand** in charge. Cia. Minas Matagalpa is operating the La Reina, Santa Teresita, and Canton mines in the Matagalpa district, about 10 miles east of the town of that name, capital of the Department of Matagalpa, Nicaragua.

D. A. Uebelacher, chief of the Zinc Branch of WPB, will resign effective July 1 in order to return to his former employment with Ford, Bacon & Davis, prominent engineering firm of New York. Prior to becoming chief of the Zinc Branch, Mr. Uebelacher was head of the Nickel Branch and of the Copper-Zinc Branch, successively, of WPB. Mr. Uebelacher will be succeeded by **George C. Heikes,** now deputy chief of the branch and former deputy chief of the Copper-Zinc Branch.

F. A. Wardlaw, Jr., will be assistant manager of the International Smelting & Refining Co., effective June 1, announces **James R. Hobbins,** president of the Anaconda Copper Mining Co. **A. B. Young,** whom Mr. Wardlaw succeeds, will be metallurgical manager of International and its subsidiary companies. Mr. Wardlaw has been assistant general manager of the Inspiration Copper Co. at Inspiration, Ariz., for four years. From 1912 to 1916 Mr. Wardlaw was chief mine engineer at the Utah Consolidated mine, Bingham; in 1917-1918, mine foreman, Braden Copper Co., Chile; 1919 to 1924, superintendent of the Vipont Silver Mining Co., Utah; in 1926, superintendent, Utah Delaware Mining Co.; and in 1929, he was made general superintendent of mines, International Smelting Co.

Eugene McAuliffe, president of the A.I.M.E., was selected as a representative on the John Fitz Medal Board of Awards at the meeting of the Board of Directors of the Institute held on May 21; **Thomas Thornton Read** was appointed a representative on the Engineering Societies Library Board; **W. M. Peirce** succeeds **Sam Tour** on the Research Procedure Committee of Engineering Foundation, Inc. **Donald B. Gillies** was made a member of the Hoover Board of Award; **F. F. Colcord** was reappointed representative on Engineering Foundation Board, and **Harry A. Linch,** manager of the engineering department for The Dorr Company, was appointed to the Graphical Symbols for Abbreviations and Use on Drawings Committee. The Student Chapter at the University of New Mexico was granted recognition of the A.I.M.E. on May 21.

▼ ▼ ▼

OBITUARY

John B. Patrick, of Duluth, Minn., who had been associated with Oliver Iron Mining Co. for 35 years, and who latterly had been manager of industrial relations with that company, died in Chicago on May 2 last. He was 63.

James Henry Dixon, for the last 30 years prominent in mining development in northern Ontario, died on May 2 in Toronto at the age of 71.

Robert T. B. Stewart, long in charge of the Toronto office of Canadian Industries, Ltd., died on Feb. 20 last. He was a member of the Canadian Institute of Mining and Metallurgy.

Frederick J. Morphett, assistant superintendent of North Broken Hill, Ltd., died suddenly at Broken Hill. After 14 years' service at Broken Hill Associated Smelters, Port Pirie, he became construction engineer at the North mine in 1935, and subsequently assumed the position of assistant superintendent.

Dr. Charles Rollin Keyes, geologist, educator, and writer, in 1889 assistant director of the U. S. Geological Survey, and later Assistant State Geologist of Iowa, director of the Missouri Geological Survey, and president of the Mexico State School of Mines, and founder and editor of *Pan-American Geological Magazine,* died on May 18 at Tucson, Ariz., at the age of 77.

Frederick W. Denton

An Appreciation

Frederick W. Denton, of Houghton, Mich., died at Rochester, Minn., on April 24, 1942.

Mr. Denton was born in Jersey City, N. J., on Jan. 19, 1868. He graduated from the Columbia School of Mines, in New York City, in 1889. In 1890 he went to Houghton and entered the teaching staff of the Michigan Mining School, the predecessor of the present Michigan College of Mining and Technology. He served as a professor of mining engineering at the school for several years. He was also professor of mining at the University of Minnesota, in Minneapolis. Later, Mr. Denton became assistant superintendent of the Atlantic Mining Co. At the same time he held a similar position with the Winona Copper Co. and the Baltic Mining Co.

Upon the organization of the Copper Range Consolidated Co. on Dec. 2, 1901, Mr. Denton became superintendent in charge of operations at the Baltic mine, and, in 1903, when the Trimountain mine became part of the Consolidated company, he also was placed in charge of operations at the Trimountain.

In May, 1905, Mr. Denton was appointed general manager of all mining operations of the Copper Range Consolidated Co. In 1909 he became a director and vice president of the Consolidated company.

In August, 1917, Mr. Denton retired from active duty but continued his connection with the company as vice president and managing director.

Mrs. Denton is a sister of Mr. Humphrey Chadbourne, active in the mining industry in New York City.

ARCHER E. WHEELER

New York, May 27, 1942.

Murdock R. McKenzie

An Appreciation

Murdock R. McKenzie, retired, mill superintendent at the Walker mine, in Plumas County, Calif., for 18 years, died in Sacramento on May 21, at the age of 74. He was a native of Nova Scotia, and entered the employ of Anaconda Copper Mining Co., Butte, Mont., at the age of 18. Save for a farming venture in Canada in his early life and for an interval when he joined the gold rush to Alaska, Mr. McKenzie was in the employ of Anaconda during his entire lifetime. Mr. McKenzie was a kindly man, and enjoyed a wide circle of friends, including the love and respect of all his employees. He was a strict disciplinarian, but just and kind, was always on the job, and enjoyed, most of all, a good job well done. H. A. GEISENDORFER

LETTERS

Venezuelan Gold

The Editor:

HAVING BEEN ASSOCIATED with New Goldfields of Venezuela as engineer and geologist, I was interested in the good article by N. B. Knox in the March issue of *E.&M.J.*

I wish, however, to offer a few corrections in the data presented, and know that Mr. Knox will accept this comment in the manner in which it is intended—namely, a striving for accuracy.

The cross-section B-K should be reversed or the notation changed.

All the veins do not occupy thrust faults, though such is true of Union, Sosa Mendez, and probably Laguna. Nor are "sharply defined walls the rule"; such is true only with some of the smaller veins; i.e., true fissure-type veins, like Chile, the section of A lode known as Pryor, isolated cases in the upper levels of the Laguna lode, and Columbia lodes where later phases of metasomatic ore deposition have not occurred. The most extensive orebodies in A lode, Laguna, Union, and Sosa Mendez have no defined walls.

It would probably indicate the formation better to adhere to Dr. McClaren's notation of "Moco Hierro" than to show "Laterite." Actually the area is much more extensive than shown, and the formation a basaltic agglomerate, ironstone.

Chloritization of the host rock (termed "greenstone") is not confined to vein or lode "walls" but has been a very prevalent type of alteration along with the intense dynamic metamorphosis over a greater part of the district wherein the deposits occur.

"Aside from quartz and gold," states Mr. Knox, "the only other minerals present are calcite, ankerite, tourmaline, pyrite, and rare grains of chalcopyrite." Possibly Mr. Knox's time for close observation was so limited that many of the other common minerals were not noticed, such as abundant sericite, siderite, lesser amounts of bornite, sphalerite, and galena.

The decimal point is missing in the figure "Bs. 023 per kilowatt hour" for power generation. One might assume this to be Bs. .023, which, at present exchange, would be approximately 7.1 mils per kw.-hr. As I recall about four years ago power costs were in the neighborhood of 3.3¢. per kw.-hr.

Other than the above points the article presents a realistic picture of operations during my association with New Goldfields in 1938 and '39.

It might be added, however, that the geological map, as taken principally from Dr. McClaren's original, hardly conveys more than a sketchy idea of the geology of the district. The terrain is notably difficult to map closely because of the heavy bush and tropical growth.

Nevada City, Calif. PAUL A. BUNDY

The Editor:

THE ARTICLE entitled "Venezuelan Gold from El Callao," by N. B. Knox, in the March issue of *E.&M.J.* is the first to be published on the region for a considerable time. Unfortunately

(Continued on page 108)

Summary of the

MARKETS

ZINC distribution, through allocation, was taken over by the Division of Industry Operations of the War Production Board on June 1. Excepting that consumers asked for more High Grade zinc than the tonnage available, formal allocation proceedings occasioned no difficulties. The entire zinc industry was fully prepared for the change. Allocation of both arsenic and tantalum became a fact during the month of May, and regulations were issued in reference to the use of "strategic" mica. Except for a $10 reduction in the price of iridium, to $165 an ounce troy, quotations for non-ferrous metals showed no change.

The *E.&M.J.* price index for May was unchanged for the fourth consecutive month at 85.90. A year ago the index stood at 83.51 and two years previous at 77.68.

Domestic consumption of copper during the first four months of 1942 averaged close to 125,000 tons a month. Domestic production of crude during April totaled 94,314 tons, of which 85,763 tons was primary metal, 3,716 tons custom-primary, and 4,835 tons secondary. Output should exceed 100,000 tons a month toward the start of the fourth quarter.

The Copper Recovery Corp. was formed by the Government to recover metal now "frozen" because of conservation orders. It is estimated that the equivalent of 255,000 tons of copper and 45,000 tons of zinc will be salvaged in one form or another.

Foreign copper has been moving into the United States in volume, largely from Latin America. Jesse Jones stated that the RFC, through its subsidiaries, had purchased 760,000 tons of copper from Latin American countries and also arranged to import the metal from Africa, Australia, and New Zealand. Purchases of Mexican copper, lead, and zinc were concluded during May, involving large tonnages. Mexican lead, formerly purchased on the basis of 4c. a pound, point of entry in Texas, will now come in at about 5½c. a pound, according to Mexican press reports. Cerro de Pasco, operating in Peru, sold 30,000 tons of lead to Metals Reserve Co.

Though lead's statistical position has improved since the first of the year, the

UNITED STATES MARKET

1942	Electrolytic Copper (a) Domestic Refinery	Electrolytic Copper (b) Export Refinery	Straits Tin New York	Lead New York	Lead St. Louis	Zinc St. Louis
May						
1	11.775	11.700	52.000	6.50	6.35	8.25
2	11.775	11.700	52.000	6.50	6.35	8.25
4	11.775	11.700	52.000	6.50	6.35	8.25
5	11.775	11.700	52.000	6.50	6.35	8.25
6	11.775	11.700	52.000	6.50	6.35	8.25
7	11.775	11.700	52.000	6.50	6.35	8.25
8	11.775	11.700	52.000	6.50	6.35	8.25
9	11.775	11.700	52.000	6.50	6.35	8.25
11	11.775	11.700	52.000	6.50	6.35	8.25
12	11.775	11.700	52.000	6.50	6.35	8.25
13	11.775	11.700	52.000	6.50	6.35	8.25
14	11.775	11.700	52.000	6.50	6.35	8.25
15	11.775	11.700	52.000	6.50	6.35	8.25
16	11.775	11.700	52.000	6.50	6.35	8.25
18	11.775	11.700	52.000	6.50	6.35	8.25
19	11.775	11.700	52.000	6.50	6.35	8.25
20	11.775	11.700	52.000	6.50	6.35	8.25
21	11.775	11.700	52.000	6.50	6.35	8.25
22	11.775	11.700	52.000	6.50	6.35	8.25
23	11.775	11.700	52.000	6.50	6.35	8.25
25	11.775	11.700	52.000	6.50	6.35	8.25
26	11.775	11.700	52.000	6.50	6.35	8.25
27	11.775	11.700	52.000	6.50	6.35	8.25
28	11.775	11.700	52.000	6.50	6.35	8.25
29	11.775	11.700	52.000	6.50	6.35	8.25
30	Holiday	11.700	Holiday	Holiday	Holiday	Holiday
			AVERAGES FOR MONTH			
May	11.775	11.700	52.000	6.50	6.35	8.25
May			AVERAGES FOR WEEK			
6	11.775	11.700	52.000	6.50	6.35	8.25
13	11.775	11.700	52.000	6.50	6.35	8.25
20	11.775	11.700	52.000	6.50	6.35	8.25
27	11.775	11.700	52.000	6.50	6.35	8.25
May			CALENDAR WEEK AVERAGES			
2	11.775	11.700	52.000	6.50	6.35	8.25
9	11.775	11.700	52.000	6.50	6.35	8.25
16	11.775	11.700	52.000	6.50	6.35	8.25
23	11.775	11.700	52.000	6.50	6.35	8.25
30	11.775	11.700	52.000	6.50	6.35	8.25

SILVER, GOLD AND STERLING EXCHANGE

1942	Sterling Exchange "Checks" (Nominal)	Sterling Exchange "90-day demand"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
May						
1	401.000	(f)	35.125	23.500	168s	$35.00
2	401.000	(f)	(e)	(e)	(e)	35.00
4	401.000	(f)	35.125	23.500	168s	35.00
5	401.000	(f)	35.125	23.500	168s	35.00
6	401.000	(f)	35.125	23.500	168s	35.00
7	401.000	(f)	35.125	23.500	168s	35.00
8	401.000	(f)	35.125	23.500	168s	35.00
9	401.000	(f)	(e)	(e)	(e)	35.00
11	401.000	(f)	35.125	23.500	168s	35.00
12	401.000	(f)	35.125	23.500	168s	35.00
13	401.000	(f)	35.125	23.500	168s	35.00
14	401.000	(f)	35.125	23.500	168s	35.00
15	401.000	(f)	35.125	23.500	168s	35.00
16	401.000	(f)	(e)	(e)	(e)	35.00
18	401.000	(f)	35.125	23.500	168s	35.00
19	401.000	(f)	35.125	23.500	168s	35.00
20	401.000	(f)	35.125	23.500	168s	35.00
21	401.000	(f)	35.125	23.500	168s	35.00
22	401.000	(f)	35.125	23.500	168s	35.00
23	401.000	(f)	(e)	(e)	(e)	35.00
25	401.000	(f)	35.125	Holiday	Holiday	35.00
26	401.000	(f)	35.125	23.500	168s	35.00
27	401.000	(f)	35.125	23.500	168s	35.00
28	401.000	(f)	35.125	23.500	168s	35.00
29	401.000	(f)	35.125	23.500	168s	35.00
30	Holiday	Holiday	Holiday	(e)	(e)	Holiday
			AVERAGES FOR MONTH			
May	401.000	..	35.125	23.500	....	35.00
May			AVERAGES FOR WEEK			
6	401.000	..	35.125	.....	....	.....
13	401.000	..	35.125	.....	....	.....
20	401.000	..	35.125	.....	....	.....
27	401.000	..	35.125	.....	....	.....

Calendar week averages, New York Silver: May 2nd, 35.125; 9th, 35.125; 16th, 35.125; 23rd, 35.125; 30th, 35.125.

(e) Not quoted (Saturday). (f) No quotation.

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Owing to the World War and the disruption of normal trade relations, our export copper quotations, since September, 1939, have been based largely on f.a.s. transactions, ex United States ports. We deduct .05c. from the f.a.s. basis (lighterage, etc.) to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c per pound over the current market for Prime Western but not less than 1c over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(c) Silver other than newly-mined domestic, by Handy & Harman. Under Treasury order of July 6, 1939, the price on domestic newly-mined silver mined subsequent to July 1, 1939, was fixed at 71.11c per troy ounce. Handy & Harman's quotation on newly-mined domestic silver, 999 fine was 70⅝c. throughout May.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which at present is equal to $34.9125.

plan of setting aside 15 percent of the domestic output remains in operation. Some in the industry thought that the pool might be dropped for June. Restriction in use of lead is cutting deeply into civilian consumption.

The Aluminum Company of America, at the request of Price Administrator Henderson, has agreed to make substantial reductions in prices of fabricated aluminum products. Lower cost, because of volume production, is the reason for the cut. Jesse Jones disclosed that aluminum production at present is at the rate of 500,000 tons a year.

The smelter in Texas is now producing tin at the rate of about 1,000 tons a month. The brand is known as "Longhorn" tin.

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LONDON TIN—Trading in Standard tin in London remained suspended throughout May.

OFFICIAL LONDON PRICES—COPPER, LEAD, ZINC

Following are the maximum prices of copper, lead, and zinc established by the Ministry of Supply for the British market, in effect since Dec. 18, 1939:

	Per £	Long s.	Ton d.
COPPER:			
Electrolytic, high conductivity	62	0	0
Fire refined, high conductivity	62	0	0
Fire refined, high grade	61	10	0
Fire refined, min. 99.7 percent	61	0	0
Fire refined, min. 99.2 percent	60	10	0
Hot rolled black wire rods	65	10	0
LEAD:			
Soft foreign, duty paid	25	0	0
Soft, Empire	25	0	0
English refined	26	10	0
ZINC:			
Foreign (G.o.b.), duty paid	25	15	0
Domestic (G.o.b.)	26	10	0
Prime Western and debased	26	10	0
Refined and electrolytic	27	5	0
Minimum 99.99 percent	28	15	0

Quotations are for metal delivered to the consumer.

E & M J PRICE INDEX

Weighted index of non-ferrous metal prices. The average for the years 1922-1923-1924 equals 100.

1929	110.33	1935	74.66
1930	82.87	1936	73.45
1931	60.20	1937	90.86
1932	48.26	1938	73.67
1933	59.79	1939	77.71
1934	69.59	1940	79.22
1941	83.49		

	1940	1941	1942
January	80.85	82.48	85.39
February	77.23	82.76	85.90
March	77.94	83.27	85.90
April	77.19	83.48	85.90
May	77.68	83.51	85.90
June	78.85	83.48	....
July	76.72	83.60	....
August	76.71	83.39	....
September	79.40	83.34	....
October	82.49	83.84	....
November	83.14	84.32	....
December	82.42	84.42	....

CURRENT PRICES — MISCELLANEOUS METALS, ORES, AND NON-METALLIC MINERALS

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

(June 1, 1942)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb	15c.
Antimony, domestic, spot, lb 5 ton or more	16.013c.
Bismuth, ton lots, lb	$1.25
Cadmium, commercial sticks, lb	90c.
Calcium, lb., ton lots 97 @ 98 per cent	$1.25
Chromium, 97 per cent grade, lb	89c.
Cobalt, 97 to 99 per cent, per lb	$1.50
Nickel, electrolytic cathodes, lb	35c.
Magnesium, 99.8 per cent, carloads, lb	22½c.
Palladium, troy oz	$24.00
Platinum, (Official quotation) troy oz	$36.00
Quicksilver, flask of 76 lb., 100 flasks or more	$193.15@$198.08
Radium, mg. radium content	$25.00@$30.00
Selenium, 99.5 per cent, lb	$1.75
Silicon, minimum 97 per cent, spot, carloads lb	14.75c.
Tellurium, lb	$1.75
Thallium, 100 lb. or more, lb	$10.00
Titanium, 96 to 98 per cent, lb	$5.00

METALLIC ORES

Beryllium Ore, f.o.b. mines, ton	$30.00@$35.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry, 48% Cr_2O_3, 2.8 to 1 ratio	$39.00
Domestic, 45%, 2.5 to 1 ratio (f.o.b. mines)	$40.50
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$4.75
Mesabi bessemer	$4.60
Old Range non-bessemer	$4.60
Mesabi, non-bessemer	$4.45
Lead (Galena) 80 per cent, Joplin, Mo., ton	$76.54
Manganese Ore, (foreign) c.i.f. U.S. ports, long ton unit of Mn:	
50 per cent	66c.
48 per cent	65c.
46 per cent	64c.
Manganese Ore, domestic, 48%, f.o.b. mines, l.t. unit	$1.00
Molybdenum Ore, 90%, per lb. of MoS_2, f.o.b. mines	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 65 per cent, duty paid	(b) $24.00
Domestic, 65 per cent and upward	(a) $26.00
Vanadium Ore, per lb. of contained V_2O_5	27½c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton	$55.28

(a) Prices at mines, small lots, usually several dollars less. (b) Nominal.

METALLIC COMPOUNDS

Arsenious Oxide (arsenic) lb	4c.
Cobalt Oxide, 70 @ 71 per cent, lb	$1.84
Copper Sulphate, 100 lb	$5.15
Sodium Nitrate, ex vessel, in 200-lb. bags, per 100 lb	$1.43
Sodium Sulphate, bulk, ton	$18.00@$24.00

ALLOYS

Beryllium Copper, master alloy, 2.5 to 3 per cent Be, per lb. of contained Be	$15.00
Ferrochrome, 65 @ 70 per cent chromium, 4 @ 6 per cent carbon, per pound of Cr contained	13c.
Ferromanganese, 78 @ 82 per cent, gross ton	$135.00
Ferromolybdenum 55 @ 65 per cent Mo. lb. of Mo. contained	95c.
Ferrosilicon, 50 percent, gross ton	$74.50
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$1.90
Ferrovanadium, per lb. of V, delivered	$2.70@$2.90

NON-METALLIC MINERALS

Asbestos, f.o.b. Canadian (Quebec) mines (U.S. funds), ton;	
Crude No. 1	$650@$750
Crude No. 2	$165@$385
Spinning fibers	$124@$233
Paper stock	$44@$49.50
Shorts	$14.50@$26.50
Vermont, f.o.b. Hyde Park:	
Shingle stock	$62.50@$65.50
Paper stock	$44.00@$53.00
Shorts	$14.50@$28.50
Floats	$19.50
Barytes, long ton:	
Georgia, crude	$9.00
Missouri, 93 per cent $BaSO_4$, less than 1 per cent iron	$6.75@$7.25
Bauxite, long ton:	
Domestic, crude, 50 @ 52 percent (not dried)	$5.00
Domestic, chemical, 55 @ 58 per cent	$7.50@$8.50
Domestic, abrasive, 80 @ 84 per cent	$16.00
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$14.50
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 85–5 per cent, all rail movement, ton	$25.00
Ground, 95 @ 98 percent, bulk, ton	$34.00
Acid, 98 and 1 percent, bulk, ton	$35.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton:	
Dead-burned, f.o.b. Washington	$22.00
Mica, per lb., North Carolina, No. 1 and 2 quality:	
1½ x 2 in.	45@65c.
2 x 2 in.	60@85c.
3 x 3 in.	$1.85@$2.05
3 x 4 in.	$2.15@$2.25
3 x 5 in.	$2.50@$2.75
White, ground, 70 mesh, ton	$60.00@$80.00
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a) 12c
Silica, in bags, 325 mesh, ton	$20.00@$40.00
Sulphur, Texas, mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
New Jersey, mineral pulp	$8.50@$10.50
Vermont, extra white, 200 mesh	$9.50@$10.00
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50
200 mesh, cream colored	$26.00

(a) Nominal

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton: Basic	$23.50
Steel, base prices, Pittsburgh:	
Billets, gross ton	$34.00
Structural shapes, 100 lb	$2.10
Bars, 100 lb	$2.15

Monthly and Yearly

AVERAGE PRICES

SILVER AND STERLING EXCHANGE

	New York		London Spot		Sterling Exchange	
	1941	1942	1941	1942	1941	1942
January	34.750	35.125	23.273	23.500	(a) 402.000	(a) 401.000
February	34.750	35.125	23.341	23.500	(a) 401.864	(a) 401.000
March	34.750	35.125	23.446	23.500	(a) 401.788	(a) 401.000
April	34.750	35.125	23.500	23.494	(a) 401.058	(a) 401.000
May	34.750	35.125	23.457	23.500	(a) 400.981	(a) 401.000
June	34.750	.....	23.400	.....	(a) 401.000	.....
July	34.750	.....	23.397	.....	(a) 401.000	.....
August	34.750	.....	23.459	.....	(a) 401.000	.....
September	34.750	.....	23.500	.....	(a) 401.000	.....
October	34.750	.....	23.500	.....	(a) 401.000	.....
November	34.772	.....	23.500	.....	(a) 401.000	.....
December	35.125	.....	23.500	.....	(a) 401.000	.....
Year	34.783	.....	23.439	.....	(a) 401.224	.....

New York quotations for silver other than newly-mined domestic, cents per ounce troy, 999 fine. London pence per ounce sterling silver 925 fine. Sterling exchange (pound sterling) in cents. (a) Nominal.

COPPER

	F.O.B Refinery, Electrolytic			
	Domestic		Export	
	1941	1942	1941	1942
January	11.819	11.775	10.257	11.508
February	11.794	11.775	10.414	11.700
March	11.814	11.775	10.592	11.700
April	11.820	11.775	10.952	11.700
May	11.815	11.775	10.950	11.700
June	11.810	.....	10.950	.....
July	11.812	.....	10.950	.....
August	11.778	.....	10.950	.....
September	11.775	.....	11.027	.....
October	11.775	.....	11.367	.....
November	11.775	.....	11.200	.....
December	11.775	.....	11.200	.....
Year	11.797	.....	10.901	.....

New York quotations, cents per pound.

LEAD

	New York		St. Louis	
	1941	1942	1941	1942
January	5.500	6.275	5.350	6.125
February	5.602	6.500	5.452	6.350
March	5.765	6.500	5.613	6.350
April	5.850	6.500	5.700	6.350
May	5.850	6.500	5.700	6.350
June	5.850	.....	5.700	.....
July	5.850	.....	5.700	.....
August	5.850	.....	5.700	.....
September	5.850	.....	5.700	.....
October	5.850	.....	5.700	.....
November	5.850	.....	5.700	.....
December	5.850	.....	5.700	.....
Year	5.793	.....	5.643	.....

New York and St. Louis quotations, cents per pound.

TIN

	Straits New York		Standard, Spot London	
	1941	1942	1941	1942
January	50.154	52.000	256.648	(b)
February	51.293	52.000	264.975	(b)
March	52.067	52.000	270.131	(b)
April	51.981	52.000	269.775	(b)
May	52.166	52.000	267.534	(b)
June	52.685	.....	262.750	.....
July	53.481	.....	258.272	.....
August	52.385	.....	257.013	.....
September	52.000	.....	256.364	.....
October	52.000	.....	255.842	.....
November	52.000	.....	256.713	.....
December	52.000	.....	(a) 257.625	.....
Year	52.018	.....	261.137	.....

New York quotations, cents per pound. London, pounds sterling per long ton. Average of 6 days. Quotations suspended Dec. 9. (b) Not quoted.

ZINC

	St. Louis			
	1939	1940	1941	1942
January	4.500	5.644	7.250	8.250
February	4.500	5.534	7.250	8.250
March	4.500	5.750	7.250	8.250
April	4.500	5.750	7.250	8.250
May	4.500	5.803	7.250	8.250
June	4.500	6.235	7.250	.....
July	4.516	6.250	7.250	.....
August	4.719	6.389	7.250	.....
September	6.104	6.920	7.250	.....
October	6.500	7.250	7.942	.....
November	6.500	7.250	8.250	.....
December	5.980	7.250	8.250	.....
Year	5.110	6.335	7.474	.....

St. Louis quotations, Prime Western, cents per pound.

CADMIUM AND ALUMINUM

	Cadmium		Aluminum	
	1941 (a)	1942 (a)	1941	1942
January	80.000	90.000	17.000	15.000
February	82.273	90.000	17.000	15.000
March	89.038	90.000	17.000	15.000
April	90.000	90.000	17.000	15.000
May	90.000	90.000	17.000	15.000
June	90.000	.....	17.000	.....
July	90.000	.....	17.000	.....
August	90.000	.....	17.000	.....
September	90.000	.....	17.000	.....
October	90.000	.....	15.000	.....
November	90.000	.....	15.000	.....
December	90.000	.....	15.000	.....
Year	88.443	.....	16.500	.....

Aluminum in cents per pound, 99 plus per cent grade. Cadmium, cents per pound. (a) Producers' price, commercial sticks.

ANTIMONY, QUICKSILVER, AND PLATINUM

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1941	1942	1941	1942	1941	1942
January	14.000	14.000	165.846	202.519	36.000	36.000
February	14.000	14.000	170.182	197.272	36.000	36.000
March	14.000	14.602	177.692	197.050	36.000	36.000
April	14.000	15.991	180.077	197.098	36.000	36.000
May	14.000	16.013	180.000	197.300	36.000	36.000
June	14.000	.....	183.920	.....	36.000	.....
July	14.000	.....	188.577	.....	36.000	.....
August	14.000	.....	192.000	.....	36.000	.....
September	14.000	.....	192.440	.....	36.000	.....
October	14.000	.....	193.615	.....	36.000	.....
November	14.000	.....	196.273	.....	36.000	.....
December	14.000	.....	199.654	.....	36.000	.....
Year	14.000	.....	185.023	.....	36.000	.....

(a) Antimony, cents per pound, ordinary brands, in cases; in bulk f.o.b. Laredo, Tex., 14.500 for May; New York equivalent 15.480. (b) Quicksilver, dollars per flask of 76 lb! (c) Platinum, per ounce troy.

PIG IRON

	Bessemer		Basic		No. 2 Foundry	
	1941	1942	1941	1942	1941	1942
January	24.50	24.50	23.50	23.50	24.00	24.00
February	24.50	24.50	23.50	23.50	24.00	24.00
March	24.50	24.50	23.50	23.50	24.00	24.00
April	24.50	24.50	23.50	23.50	24.00	24.00
May	24.50	24.50	23.50	23.50	24.00	24.00
June	24.50	.....	23.50	.....	24.00	.....
July	24.50	.....	23.50	.....	24.00	.....
August	24.50	.....	23.50	.....	24.00	.....
September	24.50	.....	23.50	.....	24.00	.....
October	24.50	.....	23.50	.....	24.00	.....
November	24.50	.....	23.50	.....	24.00	.....
December	24.50	.....	23.50	.....	24.00	.....
Year	24.50	.....	23.50	.....	24 00	.....

Iron, dollars per long ton. F.o.b. Mahoning and Chenango Valley furnaces.

Manpower Commission Will Conserve Skilled Workers

McNutt agency to prevent drafting men indispensable to essential war industries—Plans transfer of operatives from non-essential employments if necessary

ON MAY 21, Chairman Paul McNutt of the War Manpower Commission announced a program to be pursued in assuring an adequate supply of workers, particularly those with valuable training or skill, to industries essential to the war effort. This program will seek to prevent the drafting of essential skilled workmen into the armed forces, will transfer employees from non-essential to "critical" employments if voluntary movements do not provide an adequate supply, and will give special assistance to the needs of agriculture. Chairman McNutt stressed the desirability and importance of accomplishing these changes vital to the war effort voluntarily, with as little exercise of compulsion as possible. A list of eight directives was issued, describing how the program would be accomplished. Directives are as follows:

1. To the U. S. Employment Service, to prepare and maintain a list of those skilled occupations essential to war production in which a national shortage exists.

2. To the War Production Board, to classify war plants and war products in the order of their urgency in the war program.

3. To the U. S. Employment Service, to make preferential referrals of workers to employers engaged in war production in the order of their priority, before making referrals to other employers.

4. To the U. S. Employment Service, to proceed immediately to analyze and classify the occupational questionnaires distributed by the Selective Service System, to interview those individuals with skills in critical war occupations, and to refer them to job openings in war production work.

5. To the Selective Service System, to instruct local boards in areas where U. S. Employment offices exist to seek the advice of the U. S. Employment Service before classifying and reclassifying available men and women.

6. To the U. S. Employment Service, to increase its activities and facilities necessary to provide additional agricultural workers.

7. To the Farm Security Administration, to increase the number of mobile labor camps to make workers available in agriculture.

8. To the Office of Defense Transportation and the Farm Security Administration, to assure adequate transportation facilities to move migrant agricultural workers.

Strike Closes Moctezuma Property at Nacozari

THE MINE AND MILL of Moctezuma Copper Co., subsidiary of Phelps Dodge at Nacozari, Sonora, Mexico, has been closed down by a strike of the 1150 workers employed at the property. One thousand of these are miners. The strike was called after extended conversations, lasting over a month, and supervised by the labor ministry, failed to reach an agreement. The principal source of contention was the demand by labor for a contract calling for a 15 percent increase in wages, which the company refused. The company was represented in the negotiations by A. B. Williams, general manager.

Chrome Concentrator to Mill 3,000 tons per Month

THE CHROME ORE concentrator to be completed at Port Orford, Oregon, by Southwestern Engineering Co. for Krome Corp. will produce 3,000 tons per month of plus 40 percent chrome concentrates—not 300 tons as was erroneously stated in the previous issue.

Mining Division Establishes Field Offices

DR. WILBUR NELSON, Administrator of Mine Priorities, announces the opening of several regional offices of the Mining Division, WPB. These agencies will facilitate the work of procuring suitable priority treatment for mining operations within their respective territories by making direct investigations of needs, explaining to operators how to fill out various forms required, and assisting the industry in complying with rules and regulations of the Defense agencies. Names and addresses of the field representatives are as follows:

Headquarters	Name	Territory
Charleston, W. Va.	Fred Stevenson and Richard Lloyd, State Dept. of Mines, State Capitol	W. Va., Va.
Columbus, Ohio	John E. Organ	Ohio
Denver, Colo.	L. H. Hinkley and H. A. Storm, Kitteridge Bldg.	Colo., Wyo., Utah
Des Moines, Iowa	Frank West	Iowa, N. D., S. D., Neb., Kan.
Harrisburg, Pa.	R. M. McQuail and J. F. Organ, 112 Market St.	Pa., Del., Md., N. J.
Helena, Mont.	W. M. Manning, 222 Power Block	Mont., Idaho, Ore., Wash.
Indianapolis, Ind.	Carl A. Kelley, 1424 Circle Tower	Ind., Ill.
Jefferson City, Mo.	E. L. Clark, Box 395	Mo.
Little Rock, Ark.	H. A. Millar, 432 State Capitol	Ark., La., Miss., Okla.
Madison, Wis.	T. E. Gillingham, Jr., 407 Washington Bldg.	Wis., Mich., Minn.
Nashville, Tenn.	Dr. C. W. Wilson, Jr., 1014 Stahlman Bldg.	Tenn., Ala., Ky.
Raleigh, N. C.	S. A. Silver, 232 New State Office Bldg.	N. C., Fla., S. C., Ga.
San Francisco, Cal.	T. L. Goudvis, 1355 Market St.	Cal., Nev.

Reflections From Washington

(*Continued from page* 42)

More Tin Capacity—Another substantial enlargement of the capacity of the tin smelter at Texas City has been authorized. When complete the plant will be capable of handling all of the tin concentrate available to the United Nations. Two advantages are anticipated. The increased capacity provides against the contingency of bomb damage to British smelting facilities. Also, it provides for a shorter ocean haul of the large tonnage of concentrates. With limited ship capacity, this latter is an important advantage, even to British interests. No official statement is given of the total capacity for tin at Texas City. The general talk is that the new plant might produce as much as 100,000 tons of metal per year, in an emergency.

"Bill" Batt Moves Up—The resignation of William Batt as head of the Metals division of WPB has been generally misinterpreted. He retired from the post involving arduous administrative duties which have simply been turned over to his former deputy, Alexander I. Henderson. Mr. Batt retains all of the policy-making authority which he formerly had. Thus, he can give his entire time and energy to the Requirements Committee projects and to international coordination problems. The changes in personnel do not imply any changes of policy affecting mining or the metal industries.

The Mining Industry Provides the Sinews of War

Wide World Photos, Inc.

Here are seven million pounds of copper, stacked on the loading rack of the Anaconda plant at Great Falls—This spells bad news for Hitler and Hirohito

RFC Metal Program

FEDERAL Loan Administrator Jesse H. Jones, appearing before a Senate Banking and Currency subcommittee on May 8, declared that the Reconstruction Finance Corp. had purchased 760,000 tons of copper from Latin American countries, and, in addition, arranged to import the metal from New Zealand, Australia, and Africa.

Annual production of aluminum, Mr. Jones predicted, would reach 2,100,000,000 lb. when all plants in this country have been completed. The present rate of virgin aluminum production, he estimated, was 1,000,000,000 lb. a year. RFC had agreed to purchase 1,307,000,000 lb. of aluminum from Canadian producers.

Magnesium production, he testified, would result in an output of 600,000,000 lb. a year, compared with 33,000,000 lb. a year ago.

Steel capacity, Mr. Jones said, would be increased more than 10,000,000 tons.

Tantalum Output for War Uses

TANTALUM, the entire output of which is going into vital war uses, has been placed under complete allocation control by the Division of Industry Operations, WPB, effective May 22. General Preference Order M-155 provides that every person who wants tantalum must file a report on Form PD-488 and an application on Form PD-487 by the 20th of each month beginning in June.

Processors of tantalum ores or concentrates must report by the 27th of each month on Form PD-489.

Metals Reserve's Terms for Buying Manganese Ore

TERMS under which Metals Reserve Co., Washington, D. C., will purchase domestic manganese ores, subject to change without notice, are summarized as follows:

Quantity—1,000 to 10,000 long tons per contract. Larger tonnages subject to negotiation.

Deliveries—Must be completed within 18 months of date of contract.

Quality—Purchases of domestic ores will be based on three grades, as follows:

	High Grade	Low Grade A	Low Grade B
Manganese (a)	48.00%	44.00%	40.00%
Alumina (b)	6.00	10.00	No Max.
Iron (b)	7.00	10.00	No Max.
Phosphorus (b)	0.18	0.30	0.50
Silica (b)	10.00	15.00	No Max.
Zinc (b)	1.00	1.00	1.00

(a) Minimum. (b) Maximum.

Under Low Grade B, manganese ore will be accepted to 35 percent Mn, plus certain penalties.

The schedule of prices and conditions refer to black oxide ores of manganese.

Manganese concentrate to be acceptable under the schedule must be nodulized or sintered.

Manganese carbonate ores will be accepted under the schedule only if calcined.

In reference to size of ore, it is stipulated that none in excess of 12 in. will be accepted and not more than 25 percent is to pass a 20-mesh screen.

High Grade—Base price $48 per long dry ton, with an increase of $1 per ton for each unit (22.4 lb.) in excess of 48 percent. Usual penalties apply on ores falling below specifications.

Low Grade A—Base price $35.20 per long dry ton, with increase of 80c. per ton for each unit in excess of 44 percent.

Low Grade B—Base price $26 per long dry ton, with an increase of 65c. per ton for each unit in excess of 40 percent. On ore containing a minimum of 35 percent Mn, a penalty of $1.30 per ton for each unit less than 40 percent will be exacted.

An allowance will be made for each long ton shipped equal to the freight tariff per long ton from seller's nearest convenient rail station to buyer's stockpile.

Cost of sampling and analysis by the buyer. Weighing and unloading onto stockpile will be for the account of buyer. Each lot will be priced under the grade within which the specifications fall. A lot carrying 45 percent Mn but also 0.50 percent phosphorus would be priced as "Low Grade B."

Plate and Punch Mica Under Full Allocation

USE OF "STRATEGIC MICA" in products for the army and Navy is made subject to complete control of WPB by an amendment of Conservation Order M-101, issued May 23 by the Director of Industry Operations.

No such mica may be used in any product for the Army and Navy which is not an implement of war, after June 1, 1942, and none may be used in any product whatever after July 1, 1942, except by specific authorization of WPB. No strategic mica has been permitted in civilian products, except with the consent of WPB, since the effective date of the original order, March 6, 1942. This amendment therefore does not affect civilian use except to require monthly reports of inventories and to formalize machinery for obtaining permission to use the product for civilian purposes.

Greatly expanded military production now requires rigorous conservation of supplies to avert shortages, and this amendment is issued with the approval of military authorities.

"Strategic mica," not to be confused with ordinary mica "splittings" of commerce, is defined as muscovite or phlogopite (amber) block mica of a quality better than "heavy-stained."

Ceiling Put on Wholesale Machinery Prices

A COMPREHENSIVE regulation establishing maximum prices for machines and parts not covered by other price schedules was announced May 2 by Price Administrator Leon Henderson. All outstanding "freeze" letters and "informal agreements" covering machinery are superseded by the new regulation. The measure—titled Maximum Price Regulation No. 136—is part of the Office of Price Administration's over-all formal price stabilization program.

Effective May 18, 1942, the new regulation specifies Oct. 1, 1941, prices, for the machines and parts it covers, at all levels of distribution except retail. Oct. 1 rentals for machines are also established as maximum rentals.

Maximum prices for rebuilt and guaranteed second-hand machines are established at 85 percent of the Oct. 1, 1941, net price of the nearest equivalent new machine.

"Damn the torpedoes! ...full speed ahead!"

WHEN FARRAGUT stormed into Mobile Bay, his was a stirring watchword. "Damn the torpedoes! Full speed ahead!" Those are fighting words, to set the pace for a fighting nation.

And in every mine on the face of America, Farragut's slogan can still set the pace. Damn the *difficulties!* Full speed ahead! America needs both ores and minerals, that our men at the fighting front may lay down a curtain of fire against a determined and treacherous foe. Our mines must be arsenals; our miners must be soldiers. From now until final Victory dawns . . . we'll keep going full-speed to help *Keep America Rolling.*

Exide
IRONCLAD
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
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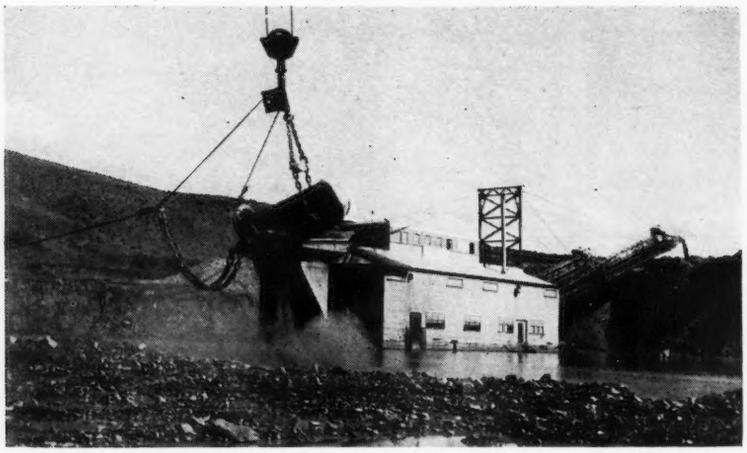


Twelve-yard bucket and gold washer of Dayton Dredging Co., Dayton, Nev.

NEVADA

Many New Operations Preparing for Production

Copper, tungsten, mercury, zinc, and gold included—Two lodes and one placer to yield scheelite—Bottle Creek mercury workings resumed

▶ International Smelting & Refining Co. continues prospect drilling at Copper Flat, two miles west of Yerington, Lyon County, employing at times three diamond drills and one churn drill. J. O. Elton, Salt Lake City, is manager. Work has been directed by Robert S. Moehlman, of the Anaconda staff. Operated by the now-defunct Empire-Nevada Copper Mining & Smelting Co., the 36-claim property was productive during World War I, its product going to the nearby Mason Valley smelter. Owners reported having received a second payment recently under the International option.

▶ Reopening of formerly productive copper mines in the Contact district, northeastern Elko County, including the Delano, principal producer of the area, is being undertaken by the newly formed Marshall Mining Co. Maurice M. Marshall, of Contact, Nev., is manager. A new survey of district copper resources has been made a special project of the U. S. Bureau of Mines at the instance of Congressman James G. Scrugham, of Nevada. Shipments to Utah smelters between 1917 and 1928 of copper ore containing some silver and gold approximated $800,000 in value.

▶ Operation by the Desert Silver Inc. of its Nivloc silver mine and 200-ton cyanide mill in Esmeralda County is faced by no prospect of early interruption because of priority restrictions, according to Fred E. Gray, general manager at Nivloc, Nev. Supplies on hand are adequate for many months; however, the labor supply situation presents difficulties and miners are needed to maintain the 150-man working force. Much of the mine work is done by contract, and capacity operation has been maintained.

▶ U. S. Vanadium Corp. is developing two scheelite properties in northern Nevada, one at Rose Creek, 14 miles southwest of Winnemucca on the Pershing-Humboldt County line and one in the Osgood range in eastern Humboldt County, a few miles from the Getchell mine. Clarence H. Hall, with office at Winnemucca, is directing engineer. Ore may be trucked to the 250-ton tungsten plant under installation in the 1,000-ton cyanide mill of the Getchell Mine, Inc., scheduled for completion in early July. At the Rose Creek property, purchased five years ago, a deep-level tunnel is being driven.

▶ California men, whose identity has not been disclosed, are assembling a 3,000-cu.yd. suction dredge and washing plant on Willard Creek in east-central White Pine County to recover scheelite from alluvial gravel. Reports at Ely said that 54 tons of equipment for the dredge, in trucks and trailers, had passed through.

▶ Resuming operation in March of cinnabar mines at Bottle Creek, Humboldt county, James O. Greenan took options on developed claims and a 20-ton rotary furnace. Late last year he closed down the Blue Can mine and furnace, after having produced over 1,000 flasks of mercury. Mr. Greenan now lives in Reno, Nev. Formerly, he was in charge of major operations for the Marsman and Hausserman interests in the Philippines. He made a test run on 200 tons of ore broken across the full width of the ore zone, with recovery of slightly more than 3 lb. of mercury per ton. Development has indicated a large volume of ore of this grade, which can be mined with small profit. A shoot of high-grade cinnabar, opened in the sedimentaries outside the vein zone, enabled production of 85 flasks of mercury in 25 days. Equipment of larger capacity is in prospect.

▶ Mine dumps of the old Polar Star mine in the Warm Creek district, in south-central Elko County, formerly a notable producer of zinc ore, are being sorted and the product is being shipped to the lately completed zinc concentrator of the International Smelting & Refining Co. at Tooele, Utah. Carl Stoddard, veteran Reno mining engineer long in charge of field work for the State Bureau of Mines, has secured a lease and option on the old mine from R. B. Walker, of Wells. Grant Jones is in charge of the ore-sorting work for Stoddard. Sampling of the large dumps by International employees was said to have indicated an average content of 18 percent zinc and over 5 percent lead.

▶ Eureka Corporation, Ltd., of Toronto, which is sinking a three-compartment shaft on Ruby Hill near Eureka, Nev., has filed with the county recorder affidavits of "proof of labor," accounting for annual assessment work on 76 contiguous lode claims in the Eureka mining district. This is in addition to a number of separate claims in that district and several in the Secret Canyon district, 8 miles south, from which the company has been shipping gold ore. The organization is a Ventures, Ltd., subsidiary.

▶ Operation of a 70-ton amalgamating and tabling mill has been resumed by George B. Austin and members of his family at the Jumbo gold mine, at Awakening, in the Slumbering Hills, Humboldt County. This property was a focal point of publicity some three years ago, when Texas oil men took a $10,000,000 option on the nearly raw prospect, making a $250,000 cash payment. Austin, a veteran miner, took the subsequent relinquishment of the option philosophically. Although the property closes down completely during the winter months, it has continued to provide a generous income for the members of the family who participated in the initial quarter-million distribution.

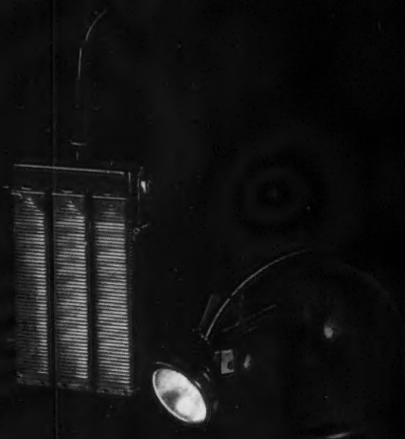
ARIZONA

Production of Various Metals on Upgrade

Cleopatra mine has large ore tonnage—Mines Department proposes tungsten plant—Bagdad and Artillery Peak developments show progress

▶ The Tom Reed mine, operated by the U. S. Smelting, Refining & Mining Company, J. H. Duriez, superintendent, continues to be the largest producer of gold from siliceous ores in the Southwest. Its production for 1941 was well in excess of $1,000,000 and unless maintenance priorities become more complicated than at present the production for 1942 will at least be equal to the 1941 record.

▶ The Cleopatra mines, situated in southern Mohave County, and recently taken over under a three year contract by Harris & Strong, of Vanadium, New Mexico, are continuing shipments of copper ore to the Clarkdale smelter by trucking service across the Bill Williams river to Aguila. The plan to ship a carload daily is now being realized, and reports are that development work being done will make possible the continued shipments at the present rate,



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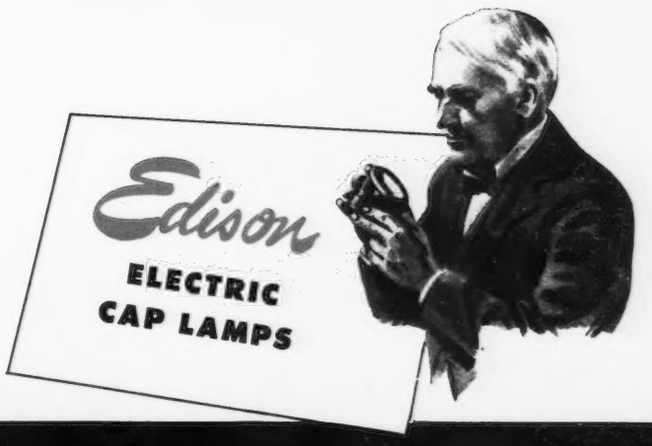

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▶ARIZONA

with possibly some increases. It is further reported that 700,000 tons of ore have already been made available. The installation consists of a gas-powered shovel and a fleet of trucks. About four miles of new road has been constructed to facilitate the haulage problem.

▶ The Gold Standard, Inc., operating the Tyro property under the management of Richard de Smet, is continuing the operation of its mill at about 240 tons daily capacity. The problem of tire shortage on truck haulage from the mine to the mill, a distance of six miles, has been at least temporarily solved. War demands for labor threaten both mine and mill operations; however, work to date has been kept at average record.

▶ Henry Berger and Harry Phillips, operating a tungsten property in the vicinity of Francis creek, in the Aquarius range 70 miles southeast of Kingman, have opened the vein at a considerable depth with an adit and have disclosed good values in tungsten. Drifting on the vein is proving the ore shoot to be of a length indicated by surface showings. They are operating under a federal loan.

▶ The probable construction of a gigantic bombing field in the Hualpai valley by the War Department will undoubtedly close down a number of small gold properties situated in the Music Mountain area and in the Gold Basin district of Mohave County. The lead-zinc properties on the eastern slope of the Cerbat range will not be disturbed, although the bombing field lines will skirt the low foothills of the eastern slope.

▶ Tungsten properties in Mohave County have been receiving the attention of a number of mining engineers, both privately employed and in the service of the U. S. Bureau of Mines. The tungsten mines of Mohave County produced a considerable tonnage of high grade ore during the First World War, and many of these properties are now attracting the attention of tungsten producers.

▶ The Arizona Lead Company, George L. Dillard, Wickenburg, general manager, operating the old Montezuma mine in the Vulture district, three miles west of Morristown, is making an effort to increase its daily capacity to 100 tons. A storage tank has been installed on the property, which is kept supplied with water for milling purposes by a pumping plant installed on the Hassayampa river. Ore for the new mill is available both from the present dumps and the mine. The new 50-ton mill is equipped with rolls, crushers and tables and is now in operation. Previously, hand-picked ore has been shipped from the dumps to the smelters, but this practice has now been discontinued.

▶ Douglas C. Corner of Douglas, Arizona, a designer of power loading equipment which has been very successfully operated elsewhere, has purchased the Wildflower, Tiger and Crown King properties, in the Mayer district, from R. C. Jones, Cushing, Oklahoma, owner of the properties. Corner is planning the installation of a 75-ton flotation plant and necessary mining equipment. The plant will be operated as a custom plant and will also treat the ores of the Tiger and other properties. The Belcher and Wizard mines in the Big Bug district, eight miles north of Mayer, are also being operated by Corner.

▶ The Arizona State Department of Mineral Resources is making an effort to obtain a treatment plant for tungsten ores similar to the one being installed at Salt Lake City for the Utah region. The new guaranteed price plan for tungsten and the demand for the ore make such an effort a logical contribution toward increasing production of the metal. Concurrently, a detailed survey is being made of the tungsten-producing districts of the state.

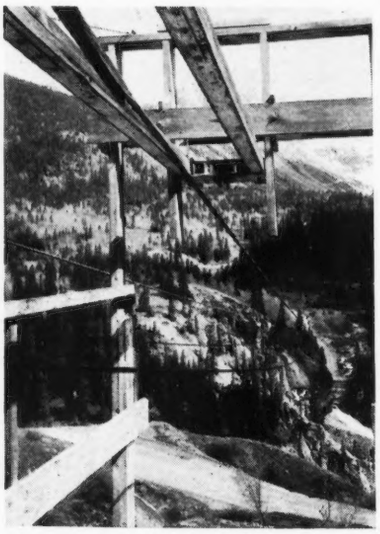
▶ Robert W. Dickey and Jack Graham, of Phoenix, have organized the War Metals Syndicate of Arizona to produce copper, tungsten and other war metals. They are at present working on a property located in Caliente canyon, Santa Cruz County, where considerable molybdenum has been disclosed in a series of parallel veins traversing the property.

▶ The State of Maine and Lone Mountain groups of claims, situated in the Empire district southeast of Vail, are shipping 100 tons of zinc ore monthly. E. P. Hilton of Tucson, Arizona, is directing operations and is also developing some lead ores, shipment of which will begin shortly. The lead ores carry some silver values.

▶ A group of 25 mining claims containing asbestos has been taken over by Arthur Enders of Globe. The group is known as the Reynolds Falls mines and is situated in the Sierra Ancha mountains about fifty miles north of Globe. An RFC development loan has been sought and an extensive development plan has been adopted. Currently, about five tons of ore are being shipped monthly to the Kyle mill operated at Globe.

▶ J. W. Still, Hillside, Arizona, manager of the Bagdad Copper Corporation which recently secured a $2,500,000 federal loan, has plans well under way to make the developments required under the terms of the loan. The new three-compartment shaft is now down nearly 150 feet and sinking continues at the rate of five feet daily. It will be sunk to a depth of approximately 500 feet. As a part of the expansion program, surveys for electrical transmission lines are being made from the power plant at Parker Dam. A 10-inch pipe line has been contracted to supply water for the proposed 2,500-ton mill. Excavations are now being made for the mill. The property has an immense tonnage of low-grade copper ore for which a successful flow sheet has been worked out by engineers and metallurgists.

▶ Diamond drilling of the big manganese deposits at Artillery Peak in southern Mohave County continues steadily, in preparation for the mining of 3,000,000 tons of manganese ore from which 240,000 long tons of manganese metal is to be extracted. In the meantime transportation, both highway and railroad, is being studied by locating engineers, to connect the property with main line facilities of the Santa Fe railway at Yucca, Arizona, 24 miles southwest of Kingman.



Shenandoah-Dives aerial tram, Silverton, Colo.

COLORADO

Mining Industry Responding to Defense Needs

Shenandoah-Dives to undertake extensive development — Yak tunnel rehabilitated — New work at Raymond mines

▶ During the first World War the third district of upper Clear Creek County was the scene of great activity in the production of molybdenum. The buildings then in use have recently been put in condition and steps are being taken to improve the road connecting the area to Highway 40 near the Berthoud Pass.

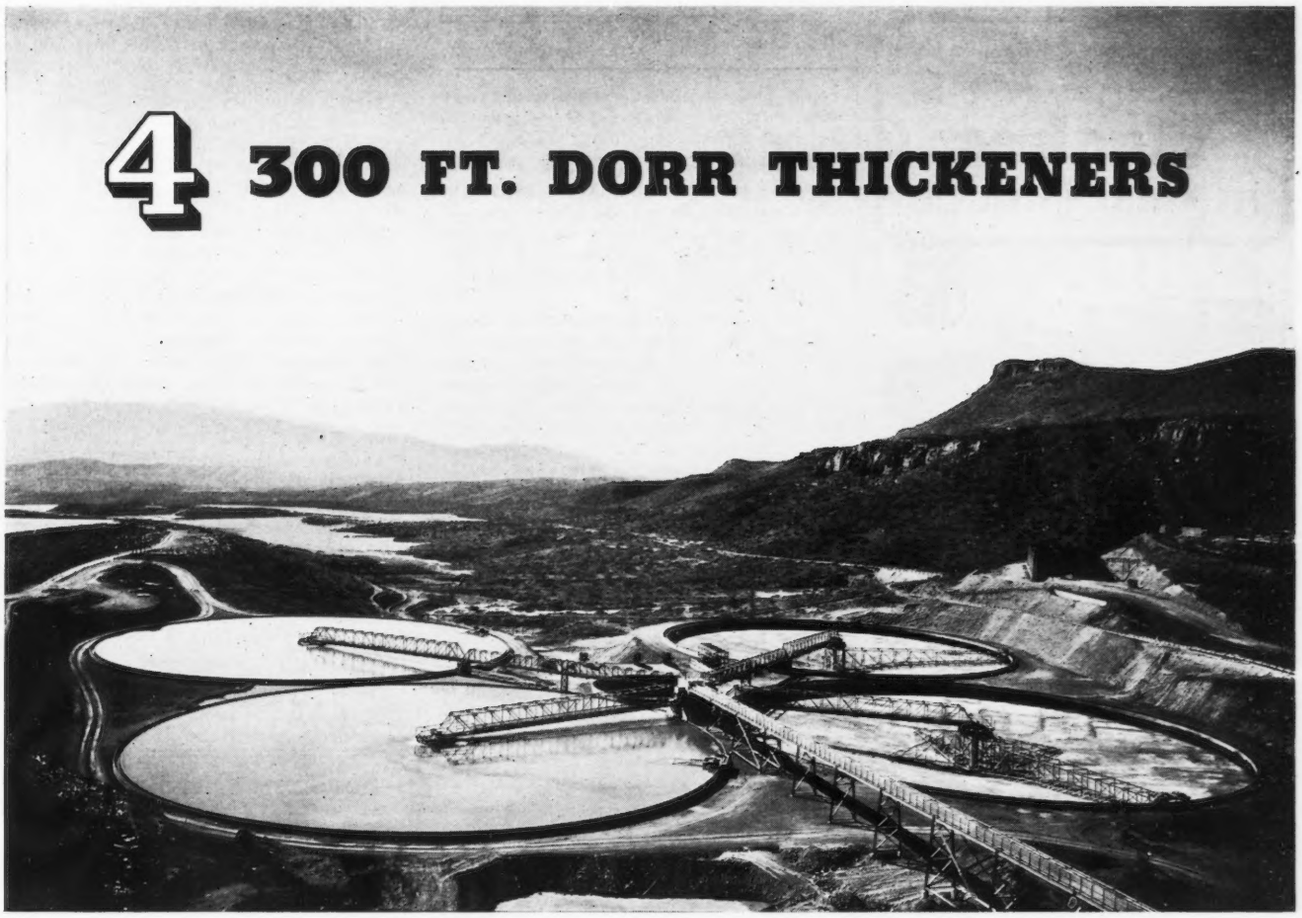
▶ Shirley Johnson, superintendent of the Mollie Kathleen mine of the Tenderfoot Mining Co., reports that two groups of leasers have opened up a good body of fair-grade ore. This property, one of the oldest in the Cripple Creek district, is on Hoosier Hill, and has been in continuous operation since the present price of gold became effective. The Tenderfoot Mining Co., financed by Denver capital, has been opened for leasing only within the last month.

▶ Wm. Lonergan, backed by Texas capital, has a large body of mill ore showing in the Cincinnati group near Silverton. Samples from the 50-ft. wide deposit, 600 ft. below the surface, carry about 10 percent lead, zinc, and copper with fair values in gold and silver.

▶ The Anna C mine, at Boulder, is being opened by John Shellenberger and Hector McKinnon. They are carrying on stoping work and unwatering of the bottom level and have a nice streak of ore in sight.

▶ The Midland Terminal Railroad has been handling as high at 244 cars of ore (nearly 14,000 tons) per week from the Cripple Creek district to the Golden Cycle mill, at Colorado Springs, and

4 300 FT. DORR THICKENERS



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▶COLORADO

could have increased this tonnage considerably were there not a shortage of railroad cars.

▶According to recent plans the Shenandoah-Dives Mining Co., under the direction of Charles A. Chase, general manager, has announced an immediate future extensive development program of its property. Ore output will be greatly increased. This program followed a meeting of Shenandoah-Dives officials with WPB and OPA representatives, in which Shenandoah appealed for assistance in needed development work. It was agreed to pay premium prices on all lead, zinc and copper output, the bonus money thus received to go directly into development work and improvement of the concentrator. This program will consist principally in driving the 1,700 level westerly and the 900 level easterly, together with some stoping and raises. Concentrator equipment is to be improved and the Silver Lake development is to proceed as planned, assuring added reserves when needed.

▶The Resurrection Mining Co., of Leadville (made up jointly of The Newmont Mining Corp., of New York, and Hecla Mining Co., of Idaho), under the supervision of L. E. Hanley, has been conducting extensive development work in the Resurrection and adjoining properties situated near the terminus of the Yak tunnel. Resurrection No. 2 shaft was extended below the Yak level and hundreds of feet of drifts have been driven to explore lead, zinc, gold, and silver deposits of the area. The tunnel has been placed in operating condition, as well as being enlarged throughout, and the installation of machinery in the 300-ton flotation unit in one of the old Yak mill buildings has been completed. This Yak tunnel, started in the early nineties, has served the mines in the eastern portion of the Leadville area. It has been extended from time to time to its present four miles. This rehabilitation of the Yak puts the Resurrection enterprise among the important mining operations of the State.

▶Development work in recent months by the Burleson Mines Co., in the Raymond mines, Gunnison County, has resulted in completion of an 800-ft. two-compartment raise on the 1,650-ft. vein to connect the lower crosscut tunnel with the upper Raymond tunnel. In 1940 the main crosscut tunnel was advanced 1,600 ft. and at this point, 4,400 ft. in, the need for better ventilation necessitated this 800-ft. raise connecting with the upper tunnel level. This work has proven up orebodies on the 500-ft. intermediate level, where a large vein of low-grade mill ore was encountered. Tests proved this ore could return a profit if milled on a large tonnage basis. A new vein cut at a distance of 3,300 ft. is still being developed and has proved that the surface or oxide ores come down to a depth of 1,600 ft. and continue to be of approximately equal value to these nearer the surface. Considerable ore is being milled from this new vein. Present heading at the 4,400-ft. point in the main tunnel is in a porphyry dike that is west of the well-known Carter mine workings, namely the Chloride and Grand Prize veins, and the main crosscut tunnel is expected to intersect these veins in the next 800 to 1,000 ft.

▶Ralph Shimmin, superintendent of the Pride mill, at Howardsville, is making extensive changes in preparation for increasing mining activity. A 2-ft. extension to the ball mill gives it a capacity of 100 tons. Two flotation cells are being added, one lead and one zinc. The mill was originally designed for 50-ton capacity. At the mine a new forge and drill sharpener have been installed; likewise a new compressor similar to the one destroyed by fire this past winter. This new machine, together with the one from the Green Mountain property, will provide air for extensive operation and development.

▶Clifford Mills and F. W. Dyer, operating the Empress mine, at Montezuma, have made the third shipment of rich lead-silver ore to the Leadville smelter. The ore has returned over 50 percent lead. They have been shipping solid galena ore high in silver. This third shipment of six tons returned them a check for $325 plus $166 government bonus.

CALIFORNIA

Scheelite Discovered at Panamint City

Fire destroys Carson Hill Gold Mining Corp. mill—Oregon Hill gold mine now operating—Sheepranch mine shut down

▶The Carson Hill Gold Mining Corp. mill at Melones, Calaveras County, was destroyed by fire on the night of May 31. The mill was of 1,200-ton capacity. This is one of the largest low-grade gold mining operations in California, with mine production coming both from a large open pit and from extensive underground workings.

▶A new source of tungsten has been discovered at Panamint City, Inyo County. It occurs as scheelite in quartz veins worked in the old camp for their silver values. The veins are in the Marvel dolomotic limestone, described in a report by F. M. Murphy in 1932 and published by the State Division of Mines. Along with the gangue, the scheelite minerals were deposited as waste on the dumps. Prospectors discovered the deposit with the aid of ultra-violet lamps in October 1941. The scheelite was first found as float at the mouth of the canyon and later traced to its source in the old quartz veins previously mined for silver in the Panamint mines. The region was recently visited by Dwight Lemmon, of the U. S. Geological Survey, and Olaf P. Jenkins, geologist, State Division of Mines, San Francisco. No development work has yet been undertaken.

▶Oregon Hill Gold Mining Co., L. F. S. Holland, general manager, has completed a 50-ton flotation mill at its gold property near Placerville, El Dorado County, and treatment of mined ore is actively under way. The mine is opened by a 320-ft. shaft and a tunnel, with exploratory and development work in progress on several levels.

▶ Installation of a 50-ton rotary mercury furnace has been completed at the property of Red Elephant Mines, Inc., near Knoxville, Napa County. The holdings are operated under a lease from A. Gradin, of San Francisco, and operations are directed by H. D. Tudor, president and general manager of the company.

▶ The Sheepranch gold mine, near Murphys, Calaveras County, operated for several years by St. Joseph Lead Co., Frank H. Skeels, manager, has been closed down. Members of the operating crew are being transferred to the company's Black P mine, at Hughesville, Mont., a lead-zinc-silver producer.

▶ Rehabilitation work is in progress at the Napoleon copper mine, near Telegraph City, Calaveras County, which is being reopened by Mountain Copper Co., Ltd., William F. Kett, general manager. The work is directed by J. M. Basham, superintendent, formerly in charge of the company's Big Canyon mine, near Shingle Springs, El Dorado County, now closed.

▶ Good progress is being made on construction of a large milling plant at the copper-gold property of Gray Eagle Copper Co., a Newmont Mining Corp. enterprise, near Happy Camp, Siskiyou County, following completion of a 23-mile power line and other plant structures. Underground development work is proceeding according to plan. Robert J. Hendricks is in charge of operations.

▶ The old Quail Hill mine, near Copperopolis, Calaveras County, is being dewatered preparatory to mining of known copper orebodies. G. I. Smith, of Bell, Calif., who acquired the property recently at a tax sale, retained Byron Rowe as general manager to direct mining operations. Current plans include leasing the nearby Mountain King mill, which, with the mine of the same name, was formerly managed by Rowe.

▶ Mining of barite has been resumed at the open pit adjoining the Spanish mine of Bradley Mining Co., near Washington, Nevada County, now operated under lease by the Industrial Minerals & Chemical Co. of Berkeley. R. J. Penrose is superintendent, and about 15 men are employed.

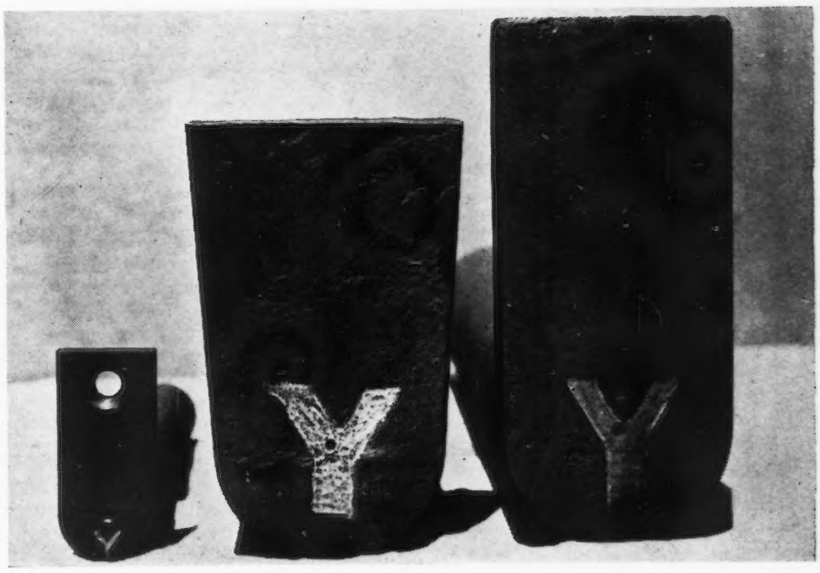
WASHINGTON

Premium Prices Reviving Old Properties

Stevens and Okanogan counties feeling boom—Deertrail and Chewelah districts reopened—Sierra Zinc active

▶ Mining has been active this spring in the northeastern counties of the State, partly because of the search for strategic minerals. Stevens County is credited with a greater variety of minerals and ores than other county in the State. According to Otto K. Quast, superintendent, West King Mining Co. has started extensive development of the Orazada mine, in the old Deertrail silver district in the southwestern part of the county. Four feet of drifting in

STEEL FORGINGS BY YUBA FOR INCREASED PRODUCTION



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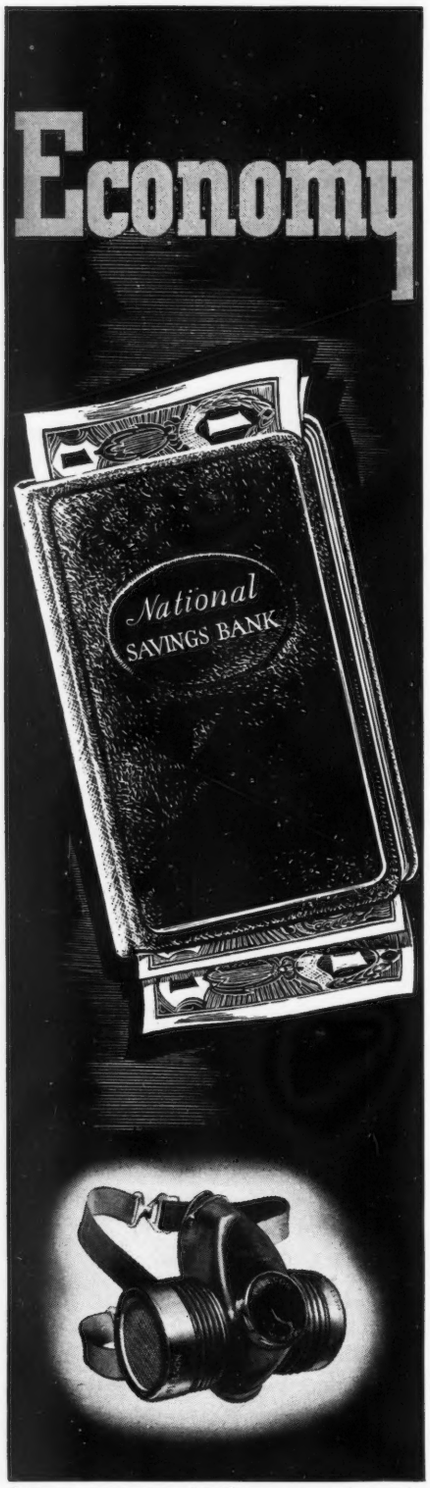

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▶WASHINGTON

the old 2,200-ft. tunnel encountered 5 ft. of ore, which continued for 120 ft. Smelter assays show good values in lead, copper, antimony, silver, and gold.

▶John Gorrien, of Minneapolis, is resuming operations on the Black Rock zinc mine and in the Washington zinc quarry, both near Northport. His engineers estimate 100,000 tons of zinc ore in the quarry. He expects to erect a 150-ton mill which will handle this and the Black Rock ores. It is assumed that his production will have the advantage of the 11c. premium price for zinc. Twenty men are employed.

▶Russell Parker has closed the First Thought mine, at Orient, and has acquired the Bonanza mine, 15 miles north of Colville. He has taken it on a lease from G. J. Vervaeke, owner. The Bonanza has three miles of tunneling and has been opened 800 ft. deep. The 50-ton mill has been modernized.

▶A. S. Newell, superintendent, reports that machinery is being installed at the United Copper mine, at Chewelah, and that electric power will be provided. There was a notable production from this property from 1912 to 1919, when copper was 17c. Operations ceased when the price of copper fell. Mr. Newell says the long tunnel will be extended to develop two veins at a vertical depth of 1,500 ft. Before attempting to unwater the mine below the 1,000-ft. level, mining will be started on that level and on the 400-ft. level. A mill is to be built. The management reports difficulty in securing competent men for constructing and mining.

▶Sierra Zinc Co., which has the old Blue Ridge, or Aladdin mine, north of Colville, is shipping lead concentrates to the Bunker Hill smelter, at Kellogg, Idaho, and zinc concentrates to the American Zinc, Lead & Smelting Co., at St. Louis. E. W. Jamison is president and one of the principal owners. Several stopes of good ore are said to have been opened. About 30 men are employed.

▶West of the Stevens County operations considerable mining is in progress in Okanogan County, near the center of the State. Kaaba-Texas Mining Co., at Nighthawk, has purchased more than $25,000 worth of equipment from Western Machinery Co., of Spokane, and will install it in the Kaaba mill, where construction was started more than two years ago. Crushers, motor, and a conveyor are included in the machinery being installed. Lee B. Carroll, of Spokane, is general manager, and reports 200,000 tons of ore blocked out. Values are about equally divided among lead, zinc, and silver.

▶S. D. Cates, of Omak, is manager of the Rich Bar Mining Co., in Okanogan County, which his father owned and operated 40 years ago. The property is on the United States side of the international boundary in the Similkameen region. Arthur M. Hull, of Toledo, is the principal owner. Mr. Cates reports that he is handicapped by the difficulty of obtaining miners and priorities on equipment.

UTAH

Bingham at Peak of Production

Several companies report increases in tonnages and profits—Fire destroys International laboratory

▶Utah Copper at Bingham is producing approximately 90,000 tons of ore daily, which output will yield 600,000,000 lb. of copper annually, as reported by Col. D. C. Jackling, president, who recently visited Salt Lake City. The company is mining 30 percent of the newly mined copper ore in the United States. To do this, ore and waste are being moved off the hill at the rate of 215,000 tons daily. In addition, the company is producing 18,000,000 to 20,000,000 lb. of molybdenum annually, or 27 percent of world production, as a byproduct of its copper mining. Under stress of war needs, copper production at Utah Copper has now reached an absolute maximum.

▶Fire totally destroyed the International Smelting & Refining Co.'s 70x350-ft. warehouse-laboratory building at the Tooele plant on May 9. Damage was unofficially estimated as being $750,000, of which $400,000 represented miscellaneous mining and milling supplies. Company officials were offered the use of facilities belonging to other smelting companies during the crisis.

▶A site at Fifth West St. between Seventh and Eighth South Sts., Salt Lake City, has been selected for the construction of a $350,000 chemical refinery to treat low-grade tungsten concentrates. The announcement was made by David D. Baker, of San Francisco, manager of Western operations for the U. S. Vanadium Corp. U. S. Vanadium will supervise the construction for the Defense Plant Corp., and operate the plant for the Metals Reserve Co., another federal agency. Capacity of the plant will be 100 tons daily. Concentrates will come from Idaho, Nevada, and Utah.

▶Installation of new equipment at the Ohio Copper Co.'s, plant at Lark, in the Bingham district, enabled the company to increase production 50 percent on May 20, according to Percy H. Kittle, president and general manager. A total of 1,500 tons of tailings per day will be treated under the new arrangement. Last year, the company produced 2,609,749 lb. of copper by treating 1,000 tons daily.

▶James A. Marsh has been appointed mine manager and consulting engineer for the Bingham Metals Co. By installing additional machinery and leasing more ground, the company proposes to treble production of the Bingham mine, which recently has been shipping gold-lead ore from the east fissure off the 1,200 level.

▶Utah Metal & Tunnel Co., properties, operated on a 20-year lease by the U. S. Smelting, Refining & Mining Co., reported a net loss of $15,612 from 1941 operations. Production amounted to 1226 tons of dry ore, principally from ground where mining would not interfere with exploration and development.

▶ Park City Utah Mines Co., showed a net profit, after depreciation and taxes, of $13,865 from 1941 operations, reports O. N. Friendly, president. This compares with a loss of $4,362 in 1940. Production totaled 18,702 tons of ore with a net smelter value of $189,678. The company spent $51,856 on development.

▶ Cardiff Mining & Milling Co. made a net profit of $3,132 in 1941 before depreciation and depletion. Net smelter returns from shipments by leasers totaled $15,269, compared with $7,447 in 1940.

▶ Howell Mining Co., plans to ship lead-zinc ore from the Globe mine, in American Fork Canyon, 50 miles southeast of Salt Lake City. The Austin mine, adjoining the Globe, has also been acquired on an option. Mining in the Tom Moore tunnel, at Alta, with the faulted segment of the Emma orebody for its objective, has been temporarily abandoned.

▶ Kearsarge, Inc., operating in the Ophir-Dry Canyon district, has struck ore in a drift from the Mono tunnel level, reports Alonzo Mackay, manager. A 4-ft. face, averaging 25 oz. silver to the ton, 20 percent lead, and 8 percent copper, is being followed in Kearsarge ground.

IDAHO

Strategic and Base Metal Production on Increase

Sunshine plans extensive manganese development—Will also recover antimony—State official urges federal roads and loans

▶ Total net profits from the silver, lead, and zinc mines of the Coeur d'Alene district for 1941 amounted to $8,472,594.36, which is nearly a half million dollars higher than in 1940. During the latter part of the year production was increased at the big producing properties by a seven-day work week. Capacity production is now in full swing at all mines in the district, and 1942 will probably be the peak production year in the history of the area. In 1940 the silver-copper-antimony mines of the silver belt accounted for more than half of the net profits, but in 1941 the lead-silver-zinc mines again forged ahead, with $5,121,694.45 net profits against $3,350,899.91 for the silver group.

Sunshine Mining Co. plans to go into the manganese ore business on a wholesale scale, operating under commission from the Metals Reserve Co. from headquarters at Philipsburg, Mont., according to R. D. Leisk, Sunshine manager. Norman Smith, Sunshine geologist, is surveying the Philipsburg district, where the company will construct a sampling plant and establish an ore-buying agency to build up a huge stockpile of high-grade manganese ore.

▶ Sunshine Mining Co. has started construction of a large antimony mill for extraction of antimony metal from the company's silver ore. The plant, with capacity of 200,000 lb. per month, will be in operation by late summer. Custom antimony ore will also be treated.

Digging Materials Vital to Mechanized Warfare

Today's conflict calls for an abundance of iron, copper, lead, zinc, manganese, bauxite, magnesite and other strategic and critical materials. Amsco Dippers, made of manganese steel, "the toughest steel known," are keeping a constant and ever-increasing flow of them from open-pit and underground mining operations to mill, smelter and blast furnace.

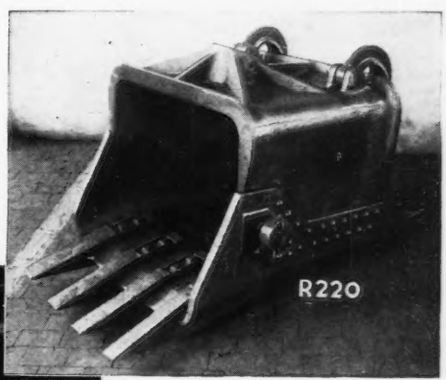
The Amsco Dipper of Renewable Lip Design shown (**R-781**) was recently shipped to a Southwest open-pit copper mining operation. It is of 4½ yd. capacity and is the latest of about fifty 4½ and 5 yd. dippers of this particular design that have been made for two American copper companies since 1936.

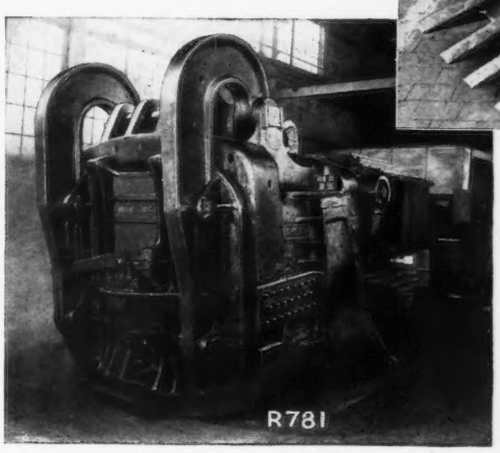
These buckets have the brute strength to stand up under heavy pressures and high speeds; and, made with sufficient metal at points of severe abrasion, they have an assured long life. Their shape was influenced by the nature of the digging, height of banks and dumping heights. Width, lip shape and tooth spacing were dictated by the comparatively short booms of new high speed shovels and meet the requirements of full filling with short travel by offering minimum digging resistance.

Numerous Amsco dippers of Missabe design are in use in the Minnesota iron range — hence the name—and, of course, in other iron mines, as well as other open-pit ore mining operations. The first dipper design in the broad Amsco line, it was introduced in 1911 and is widely used in the Americas for stripping, digging and loading.

DIGGING IRON ORE UNDER THE SEA

As stated, many Missabes are in use in open-pit mining, but several of smaller capacity are employed in an undersea iron ore mine. One of them has been in use over 20 years and has handled about 1,000,000 tons of ore. Another identical bucket (**R-220**) was put to work more recently. Both are digging over two miles out from shore below the floor of the ocean. This "baby" Missabe would make a nice pigeon hole inside one of our 18 yd. "scoops" used in Indiana coal stripping work.





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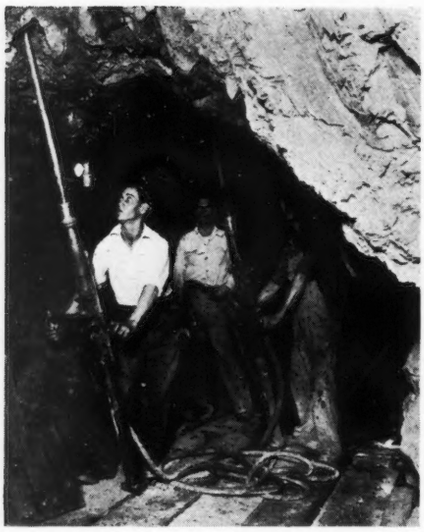

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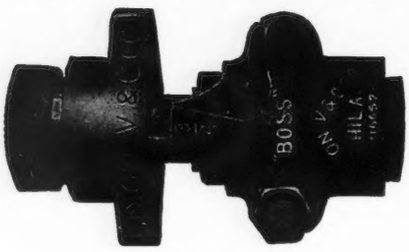

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▶IDAHO

▶ Bunker Hill & Sullivan M. & C. Co. declared its second dividend for 1942 at the rate of 25c. per share, bringing this year's total to $654,000. Grand total of Bunker Hill dividends amounts to $56,965,394.77, unsurpassed by any other mine in the Pacific Northwest.

▶ Washington Mining Co., Burke district, is seeking the rich orebody cut off by a fault in the old Hercules mine, according to John C. Glahe, of Wallace, president.

▶ Golden Anchor mine, in the Marshall Lake district of Idaho County, has shut down because of priorities orders restricting purchase of equipment for gold properties, according to President H. F. Beardslee, of Los Angeles. The mine has been in operation since 1928, with an average of 55 men employed.

▶ Highland Mines, Inc., at Twin Falls, is developing a quicksilver deposit in the Black Pine district of Cassia County, according to H. L. Walker, of Twin Falls, president. New development work includes 300 ft. of tunnel, ore bins, mine office buildings, and six miles of road construction. A three-tube retort is in operation.

▶ Hecla Mining Co. has leased the Silver Cable mine, on the Montana-Idaho boundary above Mullan, L. E. Hanley, president-manager of Hecla, has announced. Engineers estimate about 20,000 tons of zinc-lead ore ready for mining, assaying 15 percent zinc and 5 percent lead.

▶ Callahan Consolidated, north of Wallace, has started production of lead-zinc ore from the Rex tunnel on the Patuxent vein, according to President Donald A. Callahan, of Wallace. Fifty tons a day will be treated at a custom mill.

▶ Mackay Exploration Co. will erect a mill at the White Knob copper property, at Mackay, states Ted Cherry, of Mackay, president.

▶ King Gold mine, at Summit Flats, in Boise County, is being operated by Carl Haacke and Harvey Curtis, of Idaho City. A nine-day clean-up recently netted 97.75 oz. gold, valued at $2,300. Skis are used to travel to the mine until the road is opened in July.

▶ Allan C. Merritt, Idaho Commissioner of Public Works, recently told mine operators of Salmon City and Mackay that ore values in Custer and Lemhi counties would total hundreds of millions of dollars, but would lie undeveloped until the government furnishes money for road work and mine development. Merritt said $4,000,000 was needed to develop the tungsten, zinc, copper, lead, antimony, cobalt, and manganese deposits there.

▶ A new deposit of mercury-bearing ore has been discovered by the Bureau of Mines in the Yellow Pine area of Valley County, Idaho, Dr. R. R. Sayers, director, reported. Tests show the existence of ore averaging 11 lb. of mercury a ton. The orebody is 24 ft. thick, but the full extent of the find has not yet been determined.

ALASKA

Active Exploration for Strategic Minerals

Government appoints field representative —Miners and prospectors' club formed— Nickel-copper deposit reported on Chicagof Island

▶ Alaska now has a field representative of the WPB Materials Division. Jonathan Garst was appointed to this important post about the middle of May. His duties are to work with the Bureau of Mines and the Geological Survey, which are engaged in a survey of Alaska for deposits of critical minerals. Mr. Garst will assist in getting new mines into production where new deposits are uncovered, and also help in the shipment of the output of these mines to the smelters. He has full power to act for the Director of Materials.

▶ Eric Eckman conducted a one-man mine operation last season at what he calls the Chechako property at Nuka Bay and will continue his lone operation through this season. His associates in ownership are Peter Sather, of Nuka Bay, and Alfred Rosness, of Seward. There are six gold-quartz claims in the property. Single-handed, Eckman last season built a 500-ft. pipe line and installed a 75-hp. water wheel. He has a compressor and other machinery, and much of his time will be employed in installing additional equipment. Discovery of a rich stringer started him on this quest. He expects some production this year and next season he plans to employ a crew.

▶ The U. S. Geological Survey reports a nickel-copper deposit on the west shore of Chichagof Island and that two sulphide ore bodies might be worked profitably. The two deposits are estimated to contain about 10,000 tons of ore that would produce about 2 percent nickel and 1 percent copper.

▶ Treadwell Yukon Corp. stockholders have voted to dissolve the company. A liquidation dividend of about 5c. a share is available for distribution, with about 25c a share in Canadian dollar balances and securities.

▶ Don Gustafson, manager, reports that a vein of antimony has been opened in the Hi-Yu mine, in the Fairbanks district, and that a good showing of silver and lead exists in the Red Top mine, in the Kantishna district. He says the outlook at both properties is for a good season this year.

▶ George Miscovich will conduct operations this season for Pete Miscovich and sons on Flat Creek. He will employ 12 men and operate pumping and hydraulic units. Last year he was in charge of operations of the Montana Mining Co. at Omega, which will be shut down this year. Pete Miscovich himself and his sons Howard and Andrew will operate the family holdings that are situated on Discovery.

▶ Alaska Miners' and Prospectors' Club has been organized at Anchorage to promote prospecting for strategic and other

minerals. John E. Ryan is president and Mrs. Arthur Meier, secretary.

▶ Alaska Juneau will operate this season as long as possible with a crew already 300 men short, reports J. A. Williams, general superintendent. "We have a low-grade property, with profits depending on tonnage, and how long we can continue operations remains to be seen," he said. "Besides our gold output we produce a substantial tonnage of lead, and we hope to be able to produce one of the strategic metals."

▶ Frank M. Warsing, president of Quartz Creek Dredging Co., has flown from Seattle to the company's holdings on the Candle benches. He will operate with four men unless there is a water shortage.

▶ R. H. Williams, foreman for Lynch Brothers, diamond-drill contractors, of Seattle, will conduct drill explorations on Yacobi Island for the U. S. Bureau of Mines. R. S. Sanford is district engineer in charge.

▶ The U. S. Geological Survey and the Bureau of Mines will have parties in the field this season exploring for strategic and deficiency minerals. They will seek tungsten in southeastern Alaska, iron west of Ketchikan, nickel on Yakobi Island, mercury near Sleetmute and Bluff, chrome in the Yukon basin, molybdenum near Glacier Bay and Salina, antimony on the Tok, and tin near Ruby and in the Yukon. One party also will search for the lodes from which placer tin is recovered on the Seward Peninsula.

▶ Delegate Dimond is seeking to secure in the territory either a U. S. Assay office or a national bank authorized to purchase gold. At present Alaska operators pay heavy transportation and insurance charges on gold shipped to the San Francisco mint or the U. S. assay office at Seattle.

▶ Canbrae Exploration Co., a subsidiary of Bralorne Mines, is drilling for tungsten on Canadian Creek in Yukon Territory where high values have been reported from placer operations.

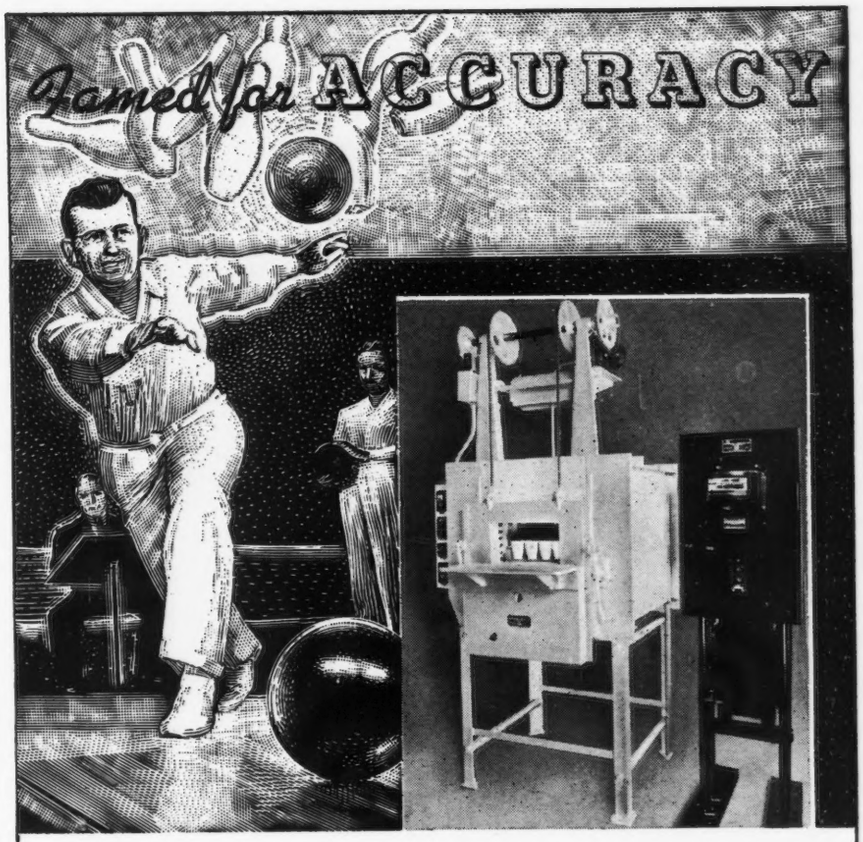
▶ Fred Craddock, manager of Morrison-Knudsen Co., reports that it took several days and a diver's crew to raise a sled load of cargo from Lake Minchumina into which it slipped when being drawn by a "cat" in March.

MICHIGAN

C. I. O. Rejected by C & H Employees

Company sinking new exploratory shaft—White Pine development awaits government approval

Employees of the Calumet & Hecla Consolidated Copper Co. voted, 736 to 656, against the proposal that the International Union of Mine, Mill and Smelter Workers, Local 584, CIO, represent them exclusively in the matter of collecting bargaining. The election, held pursuant to an agreement between the union and the company, was conducted under the supervision of John



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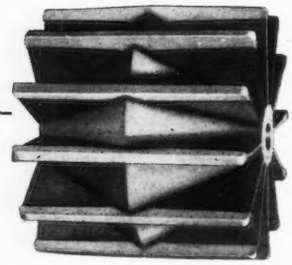

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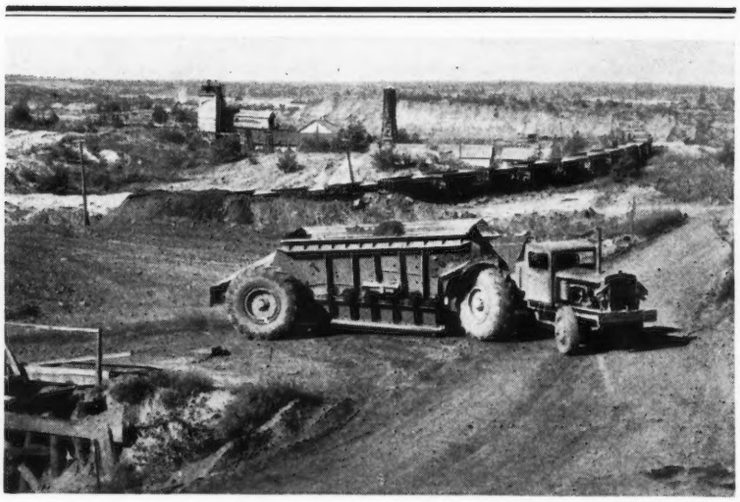


Thirty-ton truck-trailer used in hauling ore on Mesabi Range

▶MICHIGAN

E. Johnson, regional director of the 12th district of the National Labor Relations Board. Balloting took place for two days. Workers eligible to vote included production and maintenance employees only. Others, totaling 260, were barred from voting on the question of union representation.

▶ The Calumet & Hecla Consolidated Copper Company is sinking an exploratory shaft in an amygdaloid formation on Peninsula Company lands. The shaft will permit the exploration of a lode encountered in a crosscut from No. 2 Allonez shaft. At the point of contact there is an encouraging showing of copper. The vein lies about 500 feet in the hanging wall of the Calumet conglomerate. The optioning of the Peninsula lands and the purchase of the Ojibway tract have made it possible to determine the copper content over a wide area. During the past two years diamond drilling of the lodes on these lands has been prosecuted with the result that an area of better than average showing has been delineated. It is emphasized by the management that this project is to be regarded as still in the exploratory stage. Much more work will be necessary before it is determined whether or not the lode is of commercial importance.

▶ President and General Manager W. H. Schacht of the Copper Range company stated that negotiations under way with the federal government to provide funds for the development of the White Pine property, owned by Copper Range, had not yet been closed. Upon request, preliminary estimates of costs and tentative plans for the development of the property, mining and milling the ores, and smelting the concentrates were submitted in the last half of March. Mining and milling tests and investigations have been reported as encouraging. The property is located in Ontonagon County, approximately 60 miles southwest of the Champion mine owned by Copper Range. The copper occurs in two sandstone beds and parting shale underlying the Nonesuch shale. It is finely distributed and requires special treatment.

IRON COUNTRY

Record Ore Movement Expected

Shipment of ninety million tons asked by WPB—Wheat denied use of Lake fleet to speed iron-ore deliveries—New Development in southern Minnesota

▶ A total of 7,789,182 gross tons of iron ore was shipped from the Lake Superior district during April. This represents an increase of 12 percent over shipments during the corresponding month of 1941. The total tonnage shipped up to May 1, 1942 is 8,581,740 tons—an increase of 23.4 percent over last year. All possible means are being used to ship as much ore as possible, with the goal at least ninety million tons, as asked for by the federal government. An order was recently issued by the government forbidding the transport of grain by Lake vessels. Another restriction placed on the vessels is on the shuttling of boats from one port to another in order to pick up a cargo of coal. These measures are all designed to give the boats speedier trip time and give the iron ore trade maximum boat capacity for this season. Canadian boats are now entering the ore trade, which will mean an increase of at least three million tons over previous years. An all-out effort is being made by all segments of the iron mining industry, and it is anticipated that the goal will be attained.

▶ The low-grade iron ore that was investigated by the Evergreen Mines Co. of Crosby, Minn., in the southern part of the State, has now developed into an actual operation. Winston Bros. Co., St. Paul, Minn., is now constructing a concentrating plant at Etna, in Fillmore County, Minn. This company will operate the plant and the mines with the Evergreen Mines Co. It has contracted to furnish 120,000 tons of ore this year to the Koppers United Co., of Granite City, Ill. This new project realizes the possibility of iron development in this region that was foreseen by the M. A. Hanna Co. in the early thirties.

TRI-STATE

Premium Prices Stimulate New Developments

RFC stations engineer in district—Several new operations under way—Sink-and-float unit to treat tailings

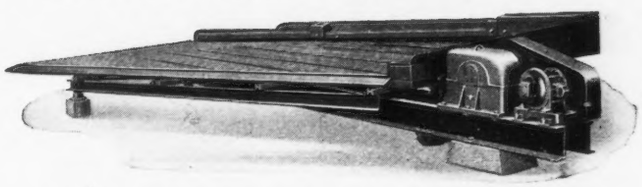
▶ Efforts to bring in new production and to expand some tailings re-treatment operations under the stimulus afforded by the federal premium price plan features new activity in the Tri-State district. A. Ben Shallit, a mining engineer for the Reconstruction Finance Corp., has been stationed in the district for several weeks to advise relative to government development loans.

▶ Work of enlargement and conversion of the No. 4 mine mill of the Evans-Wallower Zinc, Inc., southwest of Picher, into a large tailings re-treatment plant—with facilities for handling mine rock in conjunction with the tailings feed—was sufficiently advanced to permit operating around the first of June, according to Floyd W. Gooch, of Joplin, company manager. The new milling plant will have a capacity of at least 120 tons of the mixed feed per hour. Feature of the new mill is the elaborate conveying system for the feed and disposal of tailings. Tailings to be re-treated over the new plant comprise some of the richest known reserves remaining in the Picher field, and are situated principally in three large piles on the northwest forty of the 200-acre Evans-Wallower lease. The tailings available for re-treatment have been estimated at 3,000,000 tons.

▶ Tri-State Zinc, Inc., is completing an expansion program at its Ottawa and Sooner tailings plants in the Picher area. The Sooner mill has undergone general repairs throughout, preparatory to the starting of a new sink-and-float unit built in conjunction with the mill this year. The Ottawa plant has been reconditioned throughout and additional milling equipment has been installed, all of which is designed to increase the tailings tonnage capacity by 50 percent over the former rate, according to Victor C. Allen of Joplin, general superintendent.

▶ J. W. Hoffman, of Kansas City, has organized the MacArthur Mining Co.—named in honor of General Douglas MacArthur. The company has started sinking two new shafts on the Embry lease, four miles west of Baxter Springs. A. G. Johnson, of Rosiclare, Ill., consulting mining engineer, has spotted the site of each shaft on the mining tract, in which Johnson, Sid Davis, and J. W. Grantham, of Baxter Springs, are interested. Johnson and associates drilled out an orebody on the acreage a number of years ago. Four test holes were completed recently by the new company, substantiating the previous drilling. Both of the shafts will be contracted by Fred Parrish, of Joplin, and will be put down to a depth of 400 ft., Hoffman said. Arrangements have been made to treat ore from the Embry mines over the No. 3 mill of the Beck Mining Co., southwest of Baxter Springs.

From this . . .



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View within pit of Oronogo Mutual Mining Co. at Oronogo, Missouri. This is the largest open pit zinc-lead mine in world—Old underground workings are exposed in walls.

▶TRI-STATE

▶Mineral Products Co., which is backed by Pittsburg, Kan., interests, including Kenneth Spencer and associates, is reopening the Velie shaft, put down in 1937 on the Swalley land, a quarter mile west of Baxter Springs, according to W. J. Haynes, of Baxter Springs, who is in charge of the development work. The shaft is situated near the center of a quarter-section which was drilled extensively more than a decade ago by the Velie Mines Corp. More than 100 holes were put down, and zinc ore, with some lead, was encountered in many of them. In 1937 the Velie company sank the shaft to a depth of 320 ft., and dewatered the ground. With the decline in ore prices at the end of the year, the Velie company abandoned the development and later surrendered its lease. A new sinking derrick has been built by the Mineral Products company over the shaft, which has been re-cribbed around the collar. An 888-cu.ft. compressor will be installed to provide air for hoisting and pumping. An air-powered pump is to be used for lowering the water in the shaft, which stands about the 260-ft. level, Haynes said. When the water table is lowered, a turbine pump will be installed in a 16-in. drill hole 20 ft. east of the shaft, to handle the inflow and to dewater three small drifts cut out from the bottom of the shaft in 1937. Ore from the development may be transported to the Pittsburg & Midway Coal Co.'s pyrite concentration plant at West Mineral, Kan., for treatment.

▶The Jarrett mill of Kansas Explorations, Inc., formerly situated in Kansas, two miles north of Picher, has been dismantled and moved for rebuilding on the old A. W. C. mining tract, a mile and one-half west of Schifferdecker Avenue and north of U. S. Highway 66, west of Joplin, according to Ross Blake, of Joplin, district manager of the company. A double-compartment shaft, 6x12 ft. in size, has been repaired for the installation of pumping equipment and will be used as the mill shaft. A sinking derrick has been erected over a smaller shaft a few hundred feet to the southeast. The sheet-ground, which occurs in this area at a depth of about 186 ft. was last mined several years ago.

▶George W. Moore, of Joplin, president of the Northside Mining Co., reports that the company has purchased the old Superior Lead & Zinc Co. mill, formerly situated a half-mile east of Range line and a quarter-mile north of the Jasper-Newton County line in Missouri. The mill has been razed and is being rebuilt in conjunction with a derrick and hopper over the Ethel Gray shaft on the company's old Joplin-St. Louis mining tract, northwest of Chitwood. E. L. Heisten of Carthage, has contracted the construction work on the mill, which will have a capacity of approximately 25 tons of ore rock an hour when completed within a 60-day period. A rich mine, principally blende, was opened by the company at a new shaft put down some time ago in the south part of the 160-acre tract. The Ethel Gray shaft, which is situated about the center of the acreage, is to be reopened.

▶Harris Mining Co. is sinking a new shaft on the Silver Fox lease, three-quarters of a mile northwest of Treece, according to H. D. Youngman, of Baxter Springs. The shaft, which is situated in the northwest part of the 40-acre lease, will be put down to the 280-ft. level in the immediate vicinity of four drill holes put down recently by the company to check previous drill records. The shaft is about 40 ft. east of two drift headings driven up to the line on the west by the old Mid-Continent Lead & Zinc Co., Youngman said. When the mine is opened up ore will be trucked to the Youngman mill, on the old Robinson lease to the southwest, for treatment. Loren Keenan is superintendent of the company and is in charge of mining operations.

▶S. S. Clarke, of Miami, general mine superintendent for the Eagle-Picher Mining & Smelting Co., reports the starting of a new shaft on the Beck-Robinson lease, a mile and a quarter west of Cardin and a short distance southwest of the company's power and central compressor plant. A new sinking derrick has been built over the shaft and other facilities have been constructed to speed the sinking operations. The company recently completed a new shaft on the McKibben land, south of the Scott mine and mill, which are situated about a mile east of Hockerville. Drifting and mining operations have been started underground, and a railroad spur from the Scott properties has been extended to the mine for the transportation of ore to the company's Central mill. A new derrick and large hopper over the shaft, with compressor plant and change house buildings, have been erected at the mine site. According to G. C. Niday of Miami, Tri-State manager, the company is also cleaning out the old Murphy pump shaft, just south of the old Short Creek bed and about a quarter-mile west of Main St. in the old northwest Galena mining area, preparatory to the revival of extensive mine operations there. Several months ago the company drilled a number of holes in this area, disclosing ore from near the surface to a depth exceeding 100 ft. East of the Murphy shaft, the company is completing a central compressor plant. Ore from the Galena development also is scheduled to be shipped to the company's Central mill, in Oklahoma, for treatment.

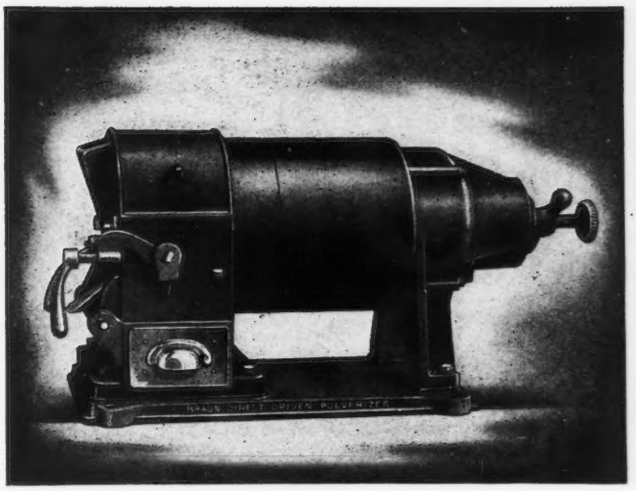
▶The old Lucky Jew "50" shaft has been reopened by the Eagle-Picher company in the extreme northwest portion of the Kansas-Oklahoma section of the mining field. The shaft, which is 330 ft. deep, has been unwatered, including a 15-ft. sump in a drift out to the west of the shaft bottom. From the drift heading, a 180-ft. pull-drift is being driven to tap an orebody disclosed by previous churn drilling on the Parmenter land, which adjoins the Lucky Jew on the west. When mine operations get under way, a spur railroad line will be extended for the transportation of ore rock to the company's Central mill.

ARKANSAS

Heavy Rains Hold Up Manganese Shipments

Numerous new shafts disclose high-grade ore—Zinc-lead field more active—New concentrating mills being built

▶Unusually heavy rains held up shipments from the Batesville-Cushman manganese field during the later half of April and the first part of May. Wad ore was water-logged, some of it carrying as much as 30 percent moisture. April shipments were: Walter H. Denison Manganese & Contracting Co., 142 tons high grade, 272 tons low grade; Arkansas Manganese Co., 200 tons of wad; C. C. Sims, 40 tons of carbonate; Skvor Manganese Co., 40 tons. The Hoxsey-Rogers Co. had 12 cars mined and ready for shipment the first week in May. This company is installing two log-washer plants.



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▶ ARKANSAS

▶ The Rogers-Bass Co. has recently taken over the John Futrall and Marcus Miller properties and has leased the Barksdale mine. Eleven shafts have been sunk on the latter property and some good leads of high-grade ore have been encountered. A 1,700-ft. flume and a water line are being built from the production shafts to the bottom of the long slope. Ore from the mines will be flushed down this flume to the bins.

▶ Five of the 40 prospect shafts that the Walter H. Denison Manganese & Contracting Co. started to sink early in April are now producing. About half of the remainder are flooded and most of them have not yet reached ore.

▶ A mid-west smelting concern that contemplates building a beneficiation plant in the field has a large crew of men at work collecting samples of low-grade ore. This collection will run four tons to the sample, with 12 sets of samples, or 48 tons, and may be used for test runs.

▶ Livingston and Grace, who are operating on Lafferty Creek, have made some good strikes of high-grade ore in several shafts. Their holdings in the field consist of 495 acres.

▶ Ira Dillard, of Mull, Ark., and R. L. McCain, of Memphis, Tenn., are prospecting a deposit of jack on the Dillard land on Buffalo River. Their drift is driven about 20 ft. into the mountain. An ore face about 15 ft. high and 30 ft. wide has been opened. The ore pile assays approximately 10 percent.

▶ The Big Jumbo Mine, near Jasper, in Newton County, Ark., is being operated by John L. Stone and associates, of Chicago. They have just completed a dry-process mill on the property to handle their ore. The ore-body is jack, and is being mined from open cuts.

▶ Moark Mining Co., which recently leased the Gloria mine, at Zinc, in Boone County, Ark., is starting construction of a 50-ton concentrating plant. The Gloria was operated by W. H. Almy during the first World War, and was a large producer of zinc silicates. The new plant is expected to be in operation within 90 days.

▶ A new strike of zinc carbonate ore has been made at the Edith mine, at Rush, Ark., in Marion County. The property is being operated by the Maricon Mining Co., which recently completed a 100-ton concentrating plant. Production from the old faces and the new strike is expected to supply the mill with ore to keep it in steady operation.

▶ Ambrose Estes, of Houston, Tex., who was active in the North Arkansas field during the first World War, has returned. With other citizens of Marion County he is trying to work out a plan to get certain Eastern and Northern investors, who own about 95 percent of the best zinc properties in the county, to start operations.

▶ The American Zinc, Lead & Smelting Co., of St. Louis, Mo., will operate the government-financed manganese processing plant to be built near Batesville. The Batesville plant will have a capacity of 400 to 500 tons daily, and actual construction may start in June.

▶ The U. S. Bureau of Mines and the U. S. Geological Survey both have exploration parties in Arkansas conducting a search over a large section in the central part of the State, and test drillings are in progress to determine the location, size, nature, and quality of ore. The search is being conducted in an area in Saline and Pulaski Counties, comprising some 250 square miles. When this work is completed the prospectors will start a new project in a section between Benton and Arkadelphia. Geophysical data were taken and plotted before the drilling began. They extended over an area much larger than the 250 square mile prospecting area. Modern instruments of prospecting are being utilized, and it is expected that much minable bauxite will be found.

▶ Representative Norrel, of Arkansas, has announced that a plant to produce synthetic cryolite and aluminum fluoride, used in manufacturing aluminum, to cost about $5,000,000, will be built near Bauxite, Saline County, Ark. The plant will be of the electrolytic type and will be operated by the Aluminum Co. of America for the Defense Plant Corp.

▶ A representative of the American Crayon Co., Sandusky, Ohio, has recently been in Arkansas investigating the Little River County chalk deposits. He says they resemble the English deposits. Because of war conditions, the Little River deposits are likely to become an important source of this nation's chalk.

▶ Hardy Herbert, of Webb City, Mo., will have charge of the zinc property to be opened soon by John B. Jameson, of Concord, N. H., and Walter Ragland, of Webb City, Mo., who have acquired the old Josie B. property on the Taney County fissure. This fissure extends from Arkansas into Missouri, crossing the State line near the mouth of Bee Creek in Boone County.

MISSOURI

Old Lead Mine Reopened in South End Lead Belt

New York syndicate leases old Catherine mine and will also operate Ozark property—St. Louis S. & R. developing Co-Ni-bearing lead mine

▶ Under the stimulus of a favorable lead market, the old Catherine mine, opened in 1898, has been leased by a New York syndicate under the name of the Fredericktown Lead Co. The adjoining Ozark mine, or the Fleming tract, which was operated on a small scale last year, has also been leased. The property is near Fredericktown, in the southern end of the disseminated lead district, and adjoins the famous Mine la Motte, which has been a lead producer for over 200 years and is now operated by the St. Joseph Lead Co.

▶ A new shaft has been completed on the Fleming tract, and under the energetic management of E. L. Petley, of New York, the property is being rapidly rejuvenated. Concentrates are being shipped to the Alton smelter of the American Smelting & Refining Co.

▶ According to Jean McCallum, general manager, the St. Louis Smelting & Refining Co. is preparing to operate a group of claims near Fredericktown, in Madison County, Mo. The deposit is a pockety occurrence of galena, carrying copper, nickel, and cobalt. The company is planning on recovering lead only initially, as the other metals are difficult to recover. However, metallurgical work is being carried on to determine whether commercial concentration of metals other than lead can be made to meet the urgent war needs, and the Metals Reserve Co. is cooperating in this work.

CANADA

Gold Mining Continues at High Rate

Priority committee formed—Western gold mines feeling priority pinch—Kerr-Addison increases reserves

▶ Industrial activity in non-ferrous metal products used 144 percent of current capacity in March, which was 182 percent of general 1937 activity as measured by the monthly index of the Canadian Bank of Commerce. Non-metallic mineral products were little changed from the 1937 rate and only 78 percent of current capacity, but the iron and steel trades operated at 319 percent of 1937 activity and 156 percent of current capacity. The wage payroll index for the whole mining industry (1937=100) stood at 122 in January and 116 in February of this year, compared with 178 for all Canadian industry. In general, more work is being done by fewer men in the mining industry. A negligible factor, at present, is curtailment of gold production, which continues to expand in Quebec while holding close to the 1941 level in Ontario and British Columbia.

▶ Robert A. Bryce, president of Macassa Mines, has given three reasons why he expects the United States to continue buying gold at the present price: The greatest stake of any country in gold; continued support to the Allied cause; and a lead to be offered in establishing a sane and efficient economic order after the war. John P. Bickell, president of McIntyre Porcupine Mines, who has taken part in important London and Washington conferences in recent months, also expresses confidence in the future of gold mining: "In the restoration of confidence and international trade, gold is bound to play a part vastly more important than most people now realize."

▶ A warning from Defense Minister Ralston that few more single men between the ages of 21 and 30 are available for military service appears to pave the way for an early call-up of the young married men. When this happens, it will be a critical blow to the mining industry. The increasing pinch in rubber, steel and other equipment for gold operators is indicated by the announcement made at the annual meeting of Dome Mines that a 250-ton reduction in the

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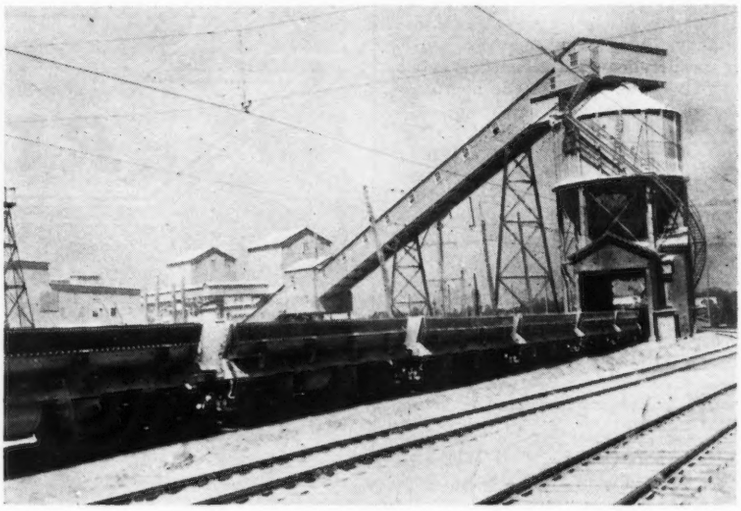

Tailings bin and train of Canadian Johns-Manville at Thetford Mines, Quebec

▶ CANADA

mill rate had been unavoidable. A similar move has not yet been forced on the industry as a whole, partly because of stocks of mine and mill supplies reported to be 40 percent above normal. The *Northern Miner* estimates that 55 leading Canadian gold mines built up their stores from $7,600,000 at the end of 1939 to $11,120,000 at the end of 1941.

▶ In cooperation with the Metals Controller, George C. Bateman, priority committees have been organized at Porcupine, Kirkland Lake, and Noranda to serve as a medium for handling applications for priority on machinery and parts made in the United States. Local authorities are responsible for regulating new orders, pooling inventories, and recommending substitutes in order to stabilize gold mining, so far as available equipment allows.

ONTARIO

▶ Legislative action, designed to assist in the development of the newly found Steep Rock iron ore deposits of western Ontario, was initiated in the Ontario Legislature on April 13, when Attorney General Conant introduced a bill covering four essential agreements necessary in connection with the draining of Steep Rock Lake. The lake is 142 miles west of Port Arthur, and preliminary exploration work, on which a million dollars has already been expended, has revealed a deposit of at least fifty million tons of 50 to 65 percent high-grade iron ore, one of the most important deposits in North America. Working of the deposit cannot be undertaken without draining of the lake, and this interferes with existing power developments. At the head of the lake is the Moose River dam and power house of the Seine River Development Co., which is controlled by the Ontario-Minnesota Pulp & Paper Co. The plant develops 10,500 hp., for the paper company's operations at Fort Frances. Draining the lake will involve removing 150 billion gallons of water. The Dominion Government is said to have guaranteed the necessary priorities for the development of the project.

▶ Production at Lake Shore Mines has been stabilized at around 1,200 tons a day. Under A. L. Blomfield, managing director and mine superintendent, operations have been worked up from the low rate of 200 tons that was reached last November and December during the Kirkland Lake strike. Before that, the problem of rock bursts had brought the mill rate down to 1,500 tons daily from the maximum of 2,500 tons. In the fiscal year ended June 30, 1941, the ore grade was $15.44 a ton and operating costs were $7.13. At the present scale of milling, annual output should total about $6,600,000, of which about $1,000,000 would be paid in taxes.

▶ J. Y. Murdock, president of Kerr-Addison Gold Mines, reports an increase in ore reserves to at least 8,000,000 tons, good for over eleven years' supply at the present mill rate of 1,904 tons daily. This reserve tonnage is calculated only to a depth of 1,450 ft., although diamond drilling has established the continuity of ore conditions down to 2,000 ft. In spite of heavy capital expenditures since first production in 1938, the company has paid dividends of $2,365,150. Taxes this year are estimated at $1.30 a ton, amounting to about $1,000,000. The consulting engineer, M. F. Fairlie, has stated that "There has been no shortage of essential materials. As to skilled labor, there is a shortage and only the future will show how serious this may be." Stoping is now geared to a program that will lead to broken ore reserves of more than 900,000 tons before the end of this year. W. S. Row, mine manager, reports that the No. 3 shaft has reached a depth of 2,350 ft., with another 500 ft. to go. Some of the large and closely spaced orebodies are to be mined by cut-and-fill, rather than the shrinkage methods formerly in use.

▶ The lowest net profit in several years is reported by J. P. Bickell, president of McIntyre Porcupine Mines, due to reduction in both tonnage and grade and an increase in operating costs. Working capital increased to $18,817,521, and ore reserves at 4,392,435 tons also marked an improvement over the previous year's record, equal to about a five-year supply for the mill. Taxes amounted to $1.70 a ton, making a total of $1,473,276 for the year. Richard J. Ennis is vice president and general manager.

▶ Progress is being made in developing a large tonnage of iron ore at the Josephine mine, Michipicoten. The property is controlled by Ventures Limited and work is supervised by Eldon L. Brown, manager of Sherritt-Gordon Mines. A mining plant has been installed and shaft sinking has reached a depth of 273 ft. Encouraging results have been disclosed by diamond drilling on an adjoining property.

▶ Moneta Porcupine Mines shows ore reserves sufficient to keep the mill running to the end of this year. It is reported that J. D. Barrington, manager, and the mine staff are not optimistic about chances for finding new ore deposits, but an independent geologist has been retained for a detailed survey of structural conditions. The 200-ton mill shows average recoveries of $19.25 a ton.

QUEBEC

▶ Belleterre Quebec Mines, 95 percent controlled by McIntyre, reports net profit of $420,656 from production of $1,634,028. Average grade was $12.94 a ton. The mine manager, Ben H. Budgeon, reports ore reserves equal to about five years' supply. Advances of $750,000 from McIntyre have been repaid, but heavy capital charges are anticipated this year for improving the hydroelectric power system and organizing the Belleterre townsite.

▶ Zinc-gold-silver ore showing good grade and width has been encountered by Golden Manitou Mines in the crosscut on the new 500-ft. level. Mine manager Andrew Robertson reports that parts of the 600-ton zinc concentrator have been completed, with most of the material delivered. Production for the first two years is under contract to the Metals Reserve Co. at a price to give an operating profit estimated at $4.32 a ton.

▶ Siscoe Gold Mines has found favorable ore conditions along the granodiorite contact at the 2,425-ft. horizon about 700 ft. west of the nearest mine workings. Information from two drill holes led to plans for crosscutting into the new area. The search for new ore has also met with encouragement in the "G" zone at the first level. A. H. Robertson, manager, reports that all cost records were broken in April, being $3.32 a ton, compared with $4.38 for all of 1941.

▶ At Senator-Rouyn the downward persistence of ore to 1,100 ft. has been indicated by three diamond-drill holes put down from the bottom 875-ft. level. The shaft is down to about 1,000 ft. and is being deepened to the 1,500-ft. horizon.

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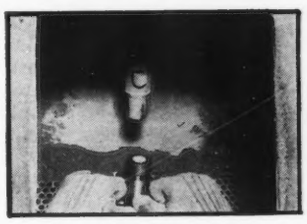

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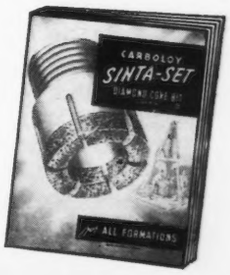

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▶CANADA

BRITISH COLUMBIA

▶ The British Columbia Department of Mines is now reserving its limited funds for road and trail construction to assist in opening areas or providing transportation facilities to properties where base metals or war minerals are known to occur, or where immediate production may be expected. Under this new policy the Department will not lend further assistance towards road or trail construction to any operating property nor to other than those dealing in the war requirements.

▶ The Provincial Mines Department is continuing its policy of aiding bona fide prospectors by assaying samples free of charge. As usual, samples will be examined carefully first by a mineralogist, supplemented this year, if necessary, by spectro-chemical analyses. Samples likely to contain strategic metals will be given especially prompt attention.

▶ Base Metals Mining Corporation, Ltd., subsidiary of The Mining Corp. of Canada, Ltd., operating the Monarch and Kicking Horse lead and zinc mines in the Golden mining division, continued production at capacity during the first quarter of 1942, obtaining an estimated operating profit of $54,518. J. H. C. Waite, president, states: "There is enough ore of present grade developed to permit milling at the current rate for the next three months, with enough ore of a somewhat lower grade for at least an additional two months. There is also a further quantity of low-grade ore, enough to supply the mill for approximately four months, but the treatment of this would entail an operating loss at present prices for metals. Exploration and development work is proceeding." During the year ended Dec. 31, 1941, gross operating profit was $183,419—slightly more than in 1940. Tonnage milled was the largest for any year since operations commenced, with ore coming about evenly from each mine.

▶ Consolidated Mining and Smelting Co. of Canada, Ltd., has notified all lessees mining gold ore on company property in the Rossland area that leases will be cancelled within 30 days. Smelting of this gold ore has to some extent restricted the production of lead and zinc at the adjacent Trail smelter.

▶ During the quarter ended March 31, 1942, Hedley Mascot Gold Mines, Ltd., Osoyoos mining division, milled 16,725 tons of ore. Net income, after provision for taxes, development, and exploration, was $61,438; earnings per share, before depreciation and depletion, were 2.71c.; and average heads for the quarter were 0.382 oz. gold per ton. The company is endeavoring to secure returns for the arsenic content of the concentrate shipped to the Tacoma smelter, where Mascot ore is understood to have proved particularly desirable for fluxing purposes.

▶ Consolidated Nicola Goldfields, Ltd., Nicola mining division, has now remodeled its mill and increased capacity to 200 tons daily. Production of a selective concentrate—zinc, lead, and scheelite—will commence at once. The Hon. H. H. Stevens, president, states that the underground situation is encouraging, with a sufficient supply of ore now broken and in ore bins to start production on a substantial scale. All mill alterations were made under the supervision of G. S. Eldridge, Vancouver consulting metallurgist, and mining operations are now in the charge of Bernard Brynelsen, formerly of the Polaris-Taku Mining Co., Ltd.

▶ During the quarter ended March 31, 1942, Bralorne Mines, Ltd., top-ranking B. C. gold producer, recovered 24,846 oz. gold, valued at $956,571, from 49,393 tons, averaging 0.503 oz. gold per ton. Some high-grade scheelite ore has been found on the fifth level of this Bridge River mine and exploration is being undertaken on the fifth and fourth levels for further occurrences.

▶ Island Mountain Mines Co., Ltd., Newmont's Cariboo subsidiary, produced 1977 oz. gold from 4,390 tons of ore milled in April. The main shaft at the Island Mountain has been deepened a further 200 ft. and a station cut at a depth of 150 ft. The objective is 450 ft., to open three new levels. Meanwhile exploration is being continued in the favorable Rainbow formation of the Myrtle group, where the long crosscut from the Shamrock group has reached its objective. A number of narrow veins have been intersected, but F. W. Guernsey, president, has advised *Engineering and Mining Journal:* "While some of these narrow veins carry good values in gold, none encountered to date has been of sufficient width to be regarded as commercial."

▶ A new company, Palisades Zinc Mines, Ltd., has been incorporated to develop, and if possible operate, the property of the Lynn Creek Zinc Mines, Ltd., on the west fork of Lynn Creek on the north shore of Burrard Inlet, within 16 miles of the City of Vancouver. The Palisades company is another of the Senator A. D. McRae-Ernest N. Patty mining enterprises, following successful placer operations in Alaska, the Yukon, and the Atlin district of British Columbia, and will be under the management and supervision of Mr. Patty. A diamond drill is being taken to the property to test downward continuation of promising surface showings.

▶ Homeward Mines, Ltd., last of the Zeballos mines to reach the production stage, has closed operations as a result of the increasing obstacles besetting the gold-mining industry. An operating profit has been earned during the brief period of production and substantial reserves have been established, and the property will be in a position to resume operation as soon as conditions become more favorable to the industry. R. C. McCorkell, managing director, states: "The directors regret having to close the mine, but our location in the most remote part of the Zeballos producing area made it most difficult to secure the necessary complement of skilled labor in an already short market. Financial problems have never been completely overcome either. However, the mine is now in a good condition, and sufficient reserves indicate that operations can be resumed on little notice."

▶ During 1941, Mount Zeballos Gold Mines, Ltd., subsidiary of Conwest Exploration Co., Ltd., produced gold valued at $375,940 from 21,261 tons averaging 0.47 oz. gold per ton. The mill averaged 59.2 tons daily. Approximately half of the ore was sorted before milling, and recovery averaged 97.4 percent. It is anticipated the developed ore will be mined during the first half of 1942, and when this is completed the operation will be shut down.

▶ Cariboo Gold Quartz Mining Co. produced 4,789 oz. of gold in March, valued at $184,376, from 10,228 tons, averaging 0.47 oz. gold per ton.

YUKON TERRITORY

▶ Canbrae Exploration Co., Ltd., wholly-owned Bralorne subsidiary, together with three major Canadian mining groups, has undertaken the exploration and development of a promising prospect carrying reported high values in tungsten, situated on Canadian Creek, a tributary of Britannia Creek. Drilling is now in progress. The property was operated with drag-line equipment during 1941 by Canadian Tungsten, Ltd.

AFRICA

Government Encourages Gold Mine Production

Also seeks expansion of strategic mineral output — Blyvooruitzicht now operating — Asanti Goldfields in good position

▶ The working profits of the Witwatersrand gold mines in February are estimated by the Chamber of Mines at £3,462,858. This is £275,249 less than in January and £207,454 less than in February a year ago. The falling off is considered to be temporary, but costs are increasing, supplies being higher in price and at times so slow in arrival as to retard operations. It appears to be the policy of the Union of South Africa Government to encourage maintenance of gold mining activities at the present rate for the duration of the war. The suggestion that output be curtailed is resented and it is argued that gold, to pay for needed imports, is an essential.

▶ Col. F. C. Stallard, South African Minister of Mines, says that coal and iron are already being produced in increasing quantities, and that inquiries have been received from the United States as to the possibility of producing more tungsten, manganese, and chrome. The government is already concentrating on the production of manganese, which occurs in large quantities. Producers of tungsten are being urged to intensify their activities, but unfortunately this ore occurs in scattered deposits. Chrome output will be expanded if transportation can be provided. Colonel Stallard also makes the interesting suggestion that diamond drills may be used in gold mining instead of steel jumpers, thereby reducing dust and silicosis.

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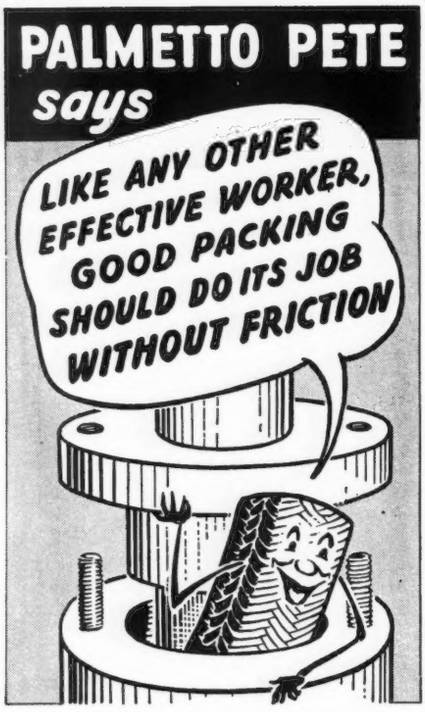

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▶AFRICA

▶ W. H. A. Lawrence, president of the Transvaal Chamber of Mines, has now confirmed the rumor that the Union of South Africa government regards the maintenance of gold production of paramount importance. He also expresses the belief that should rising costs and increasing taxation restrict activities at the new mines being developed, the government would be asked to take such action in the matter as seemed to the best interests of South Africa. If the withdrawal of men for the military effort tends to restrict such development, or to diminish production, however, there will be no protest.

▶ Blyvooruitzicht is expected to announce the result of its initial month's production soon. It is understood that the report will detail the amount recovered by straight milling without the aid of the cyanide section which is not yet completed. The work of completing its 8,000 tons per month mill has been hastened, as has everything else in connection with the development and equipment of this remarkable enterprise. It is reported unofficially that underground openings, still being rapidly extended, are continuing to reveal approximately 100 percent of payability, the average being nearly 2½ oz. per ton over widths averaging 14 in.

▶ Grootvlei Propriety Mines set up a new high record of production and profit in March.

▶ Anglo American Corp. of South Africa is paying a dividend of 25 percent for 1941 on its £2,450,000 ordinary capital. This compares with 20 percent each of the two preceding years.

▶ British South Africa Co. is again paying 1s. 5d. per share for the past year. Its profit was slightly larger, but taxation took £93,889 more.

▶ The voluntary liquidation of Lyndenburg Platinum Areas is proposed. Active operations ceased in 1930. The limited pay areas remaining do not warrant re-equipping the property for production.

▶ Ashanti Goldfields Corp. treated 228,300 tons of ore for the recovery of 264,079 oz. of gold last year, comparing with 242,865 tons and 273,107 oz. the year before. The dividends for the year are again 80 percent. Ore reserves are 2,076.516 tons averaging 21.6 dwt. per ton, an increase of 140,708 tons and a decrease of 0.2 dwt. in grade. Rising cost of supplies and services caused an increase of 1s. 11d per ton in costs. As ore reserves are sufficient to last nine years at present rate of treatment, it is not intended to increase them this year. In fact, footage driven last year was 5,500 ft. less than the year before. The richest ore is found in deep workings.

▶ Bibiani (1927) Limited reports a profit for the past year of £305,544, a decrease of £70,965. Ore reserves are now 2,548,204 tons averaging 7.17 dwt. per ton, a decrease of 192,001 tons and 0.3 dwt. in grade.

▶ Bremang Gold Dredging Co. has acquired two dredges from Tano Gold Dredging in exchange for capital shares. This will bring Bremang's equipment up to the planned four dredges.

AUSTRALIA

Government Policies Discourage Mining

Resume of South Kalgurli Consolidated and Norseman Gold Mines operations—Wattle Gully suspends production on lower levels

▶ The Australian mining industry is experiencing the most difficult period in its history. This arises not so much from the growing shortage of supplies and restrictions of available labor, as is natural during wartime, but from a lack of understanding of the function and importance of the industry, and an almost complete absence of intelligent coordination between the various sections of government which influence and control the operations of mineral production.

There has been evidence of uncertainty and concern, particularly among gold-mining interests, caused by contradictory government pronouncements as to the future of that class of mining, which, so far as Western Australia is concerned, is the main industry of the State and upon which the solvency of that particular community depends. In the early days of the war, manpower regulations were framed to protect mining, which was declared an essential industry, but owing to inefficient control and administration, such regulations have proved futile. Though exemptions from military service could be obtained for skilled employees, mining companies had no power to prevent men leaving to accept other and more remunerative employment. There has accordingly been a heavy drift of labor from mines, particularly those in the more remote and least attractive localities. Many mines, as a result, are now unable to maintain normal output, whether of gold or base metals, through the loss of skilled men and the general inefficiency of the depleted labor force remaining. The Commonwealth Government is urging greater production of base metals, either from existing mines or by the opening of idle deposits, and a special department, under able control, has been created to further this objective. Its efforts are being frustrated to a great extent by the taxation authorities, who by ill-considered taxation of the industry, are effectively preventing the introduction of new capital into mining, as well as depriving the companies of revenue which should be employed in vital development work. There is no recognition of the fact that a mine is a wasting asset from the moment when the first ton of ore is extracted and for purposes of taxation mining is regarded as comparable to ordinary industrial enterprises.

The taxation scale is so arranged that with increase of output, and consequently, operating profit, a point is reached at which companies would be operating at a loss after providing for Federal and State income and wartime profit taxes, and for the various social service taxes which in themselves impose a very material burden on the industry. The most serious imposition is the Federal wartime profits tax.

Strong efforts are being made to have the taxation system reconsidered and to secure an equitable law which will permit the mining industry to function at maximum capacity.

WESTERN AUSTRALIA

▶ At the mine of South Kalgurli Consolidated, Ltd., Kalgoorlie, the most important developments during 1941 were on the No. 2 Cross lode, south of Morty's shaft. Work has been carried on at Nos. 15, 16 and 17 levels and the orebody has been prepared for stoping. The lengths exposed on the shoots were short but values were good. Satisfactory development was also accomplished on No. 1 Cross lode. Stoping during the year was maintained around 7,000 tons of ore per month. This figure was exceeded in the four-weekly period to Jan. 13, but a marked decrease was recorded in February. The mine has responded well to development and is in a sound position. Exploration at the lowest horizons has been encouraging and preparations are in hand to sink the main shaft. The company operates the only dry crushing and roasting plant in Western Australia, a process which was popular in the earlier days of the Kalgoorlie field, but which has been replaced in all other mines by flotation followed by the roasting of the concentrate prior to cyanidation.

That a similar change-over on the South Kalgurli mine was not made, is probably due to the fact that ore reserves at the time gold mining was reorganized did not warrant the necessary expenditure. The fact remains, however, that a high recovery is made by dry crushing and roasting, although costs are somewhat higher than with the newer flotation-roasting practice. In the South Kalgurli plant grinding is done in No. 8 Krupp ball mills which receive 4-in. feed and discharge a product 50 percent of which is minus-150 mesh. This is roasted in Edwards duplex and Merton furnaces. The calcine is delivered to 8-ft. diameter grinding pans for further reduction, in which process amalgamation is carried out. An appreciable proportion of gold is recovered by this means. The pan discharge is classified, the oversize going to a tube mill and the undersize to the agitators. Filter presses are used for separation of solution from the pulp, and precipitation is effected in a Merrill-Crowe unit. It is claimed that very efficient filtration and recovery of soluble gold can be carried out in the presses. The metallurgical work in this mill is of a high order.

▶ Norseman Gold Mines, N.L., one of the two large companies working on the Norseman gold field, earned a net profit for the year ended Oct. 31, 1941, of £A49,300, compared with £A55,560 in the previous year. No dividends were paid, whereas £A58,000 was distributed in the preceding term, and a balance of £A81,689 was carried forward. The company operates two mines; the Norseman mine, which contains a large quartz lode in chlorite schist, with considerable longitudinal extent, dipping east at 43 deg.; also the Iron King mine, which is a low grade, ferruginous occurrence having a length of 1,000 ft. and a width of 300 ft.,

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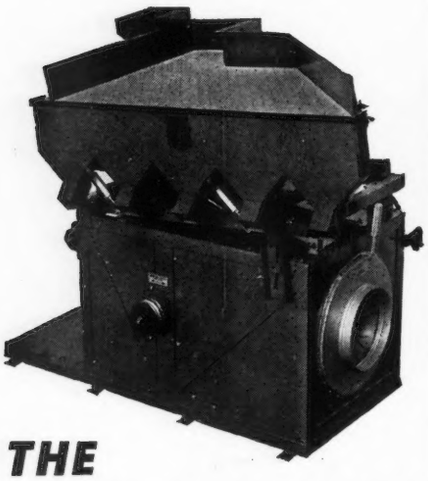

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▶AUSTRALIA

and is worked by open cut. Ore reserves in the Norseman mine were estimated at 261,000 tons having an average grade of 4.75 dwt. gold per short ton and in the Iron King mine 345,000 tons worth 2.3 dwt. per ton. Development carried out in the Norseman mine totaled 4,465 ft., with 1,100 ft. of diamond drilling and 730 ft. of stope preparation which increased ore reserves by 28,000 tons over extraction. Due to the large tonnage of reserves in the Iron King mine, development work was confined to percussion drilling, of which a total of 1,665 ft. was completed. Of the 4,465 ft. of development in the Norseman mine 1,781 ft. was directly productive. In the previous year, also, non-productive exceeded productive development, but the reverse was the case in the two preceding years. The main shaft has an inclined depth of 1,372 ft. and Brown shaft, which is being sunk 1,840 ft. south of the main shaft, has reached an inclined depth of 380 ft. During the year 112,366 short tons of ore, worth 4.21 dwt. per ton, were broken in the Norseman mine and 49,533 tons in the Iron King, a total of 161,899 short tons having an average assay value of 2.13 dwt. per ton. Despite reductions in manpower a greater tonnage of ore was broken in the Norseman mine, due to additional mechanical aids, improved organization, and more efficient servicing. The total ore treated from the two mines as well as from the Norseman Developments and Norseman Associated mines, controlled by the company, amounted to 173,992 tons, from which 27,804 oz. of gold was recovered. Residues assayed 0.307 dwt. per ton.

VICTORIA

▶Wattle Gully Gold Mines, N. L., at Chewton, 23 miles south of Bendigo, and one of the State's leading gold producers, earned a net profit of £A32,434 in the half year ended Dec. 31, 1941, which compares with £A31,131 in the previous half-year and £A38,496 in the corresponding period of 1940. The result is satisfactory, as the mine has been faced with increasing difficulty in maintaining an adequate labor force. To meet this position it was decided early this year to cease work at all levels below No. 8 and to concentrate operations at and above that horizon. The decision was based on the facts that although a good lode has been opened up on Nos. 9 and 10 levels, the mean stoping width is about 15 ft., whereas at and above No. 8 level the stopable width frequently exceeds 40 ft.; also the lower levels are worked from an internal underlay shaft and ore must be transported some distance on No. 8 level to the main vertical shaft, thus increasing working costs. During the period of six months 16,709 tons of ore was milled for a yield of 5,860 oz. of smelted gold; plates yielded 246 oz. from cleaning, and with realization from concentrates, proceeds from gold were £A60,047, from which six dividends of 6d. per share required £A27,000. Inasmuch as conditions are becoming increasingly difficult in regard to labor and stores, it is probable that this rate of distribution may not be maintained in the future, although it is expected that the grade of ore mined will be somewhat higher than in the past. Diamond drilling from No. 2 shaft, in the northern part of the lease; and development north from the main shaft proved the continuation of the lode in this direction, so that a successful future is considered assured for some years. At No. 8 level, crosscutting eastward has been extended and a lode formation exposed for 100 ft. This is not true width, for the dip is west at 43 deg.; the formation carries good values in parts. The north drive on this level has been extended to 580 ft. from the shaft in formation carrying gold, with good-grade ore at intervals. The mine is equipped with a 30-head stamp battery, gold being recovered on plates, and mineral is concentrated on Wilfley tables and strakes. It is a notable feature in Victorian gold mining that the gold content of the mineral in a number of fields, such as Bendigo, Chewton, Daylesford, and the mountain districts to the east, is about 1½ dwt. per ton. The mineral is pyrite, with a very small quantity of arsenopyrite, and is sold to customs treatment works at Bendigo. In the fields mentioned, and indeed, throughout the State, there is a marked association of gold with galena and zinc blende. These two minerals occur sparingly and in irregular scattered specks, but wherever they are observed gold is usually found in their vicinity, so that their presence is regarded as a valuable guide in prospecting and exploratory work.

NICARAGUA

Minas Matagalpa Continues Operations

War interferes with plans to adopt diesel-electric power—Canton vein to be opened this summer when water power is available

Cia. Minas Matagalpa, operating La Reina, Santa Teresita, and Canton mines, in the Matagalpa district, was organized about 1936 by Henry F. LeFevre, Henry B. Price, and John A. Willey, according to C. Carleton Semple, general manager, who contributes the following notes on current operations. The company's first step was to drive a 1,200-ft. crosscut to the La Reina vein, giving about 400 ft. of backs below the outcrop. About a quarter million dollars was needed to build a mill, hydroelectric plant, and 8½-mile transmission line, and to equip the mine. The interests that were developing La India decided to take a flyer in the Matagalpa venture, and in September 1938 the mill started grinding. In three years the investment was paid back with much better than bank interest, and to date over a hundred thousand tons of ore has been mined. More than a million dollars in gold has been produced, two dividends have been paid, and there is a six-figure balance in the bank; but for a time there were those that feared maybe a weak sister had been picked up.

▶The mill is a Hardinge-equipped simple counter-current decantation plant, treating over 3,000 tons per month. The hydroelectric plant gives about 280 hp. available at the mill end of the 11,000-volt transmission line. Most of the

motors are of the squirrel-cage type, and the company is now trying to get an export license for enough capacitors to improve its power factor. A year ago most of the ore mined was from above the crosscut level and hoisting and pumping had to be done. Now the 150-ft. and 300-ft. levels are open, representing inclined depth on the 45-deg. dipping vein. This called for more power, and two 100-hp. Cummins diesel-electric generating units and a six-wheel all-wheel drive Marmon-Herrington truck were ordered, to haul oil over 10 miles of bad road from Matagalpa. Plans were made for a long crosscut tunnel to undercut the old La Leonesa workings, which were acquired from Mr. Willey, but the war curtailed these developments. However, the original La Reina 1,200-ft. crosscut is being extended another 1,600 ft. to cut the Canton vein. A winze was sunk 220 ft. on this vein and opened up one level about 150 ft. below the outcrop; there the winze cut a watercourse. There was good ore all the way down and of good width. The crosscut should cut the Canton vein some 500 to 600 ft. below the outcrop within the next two months as soon as the rains return to make water available. If the vein does continue down and the grade holds out the La Reina workings may be abandoned until a more propitious time when power units are easier to purchase. The company also owns gold claims in Nueva Segovia, to the north, but they are for a later era.

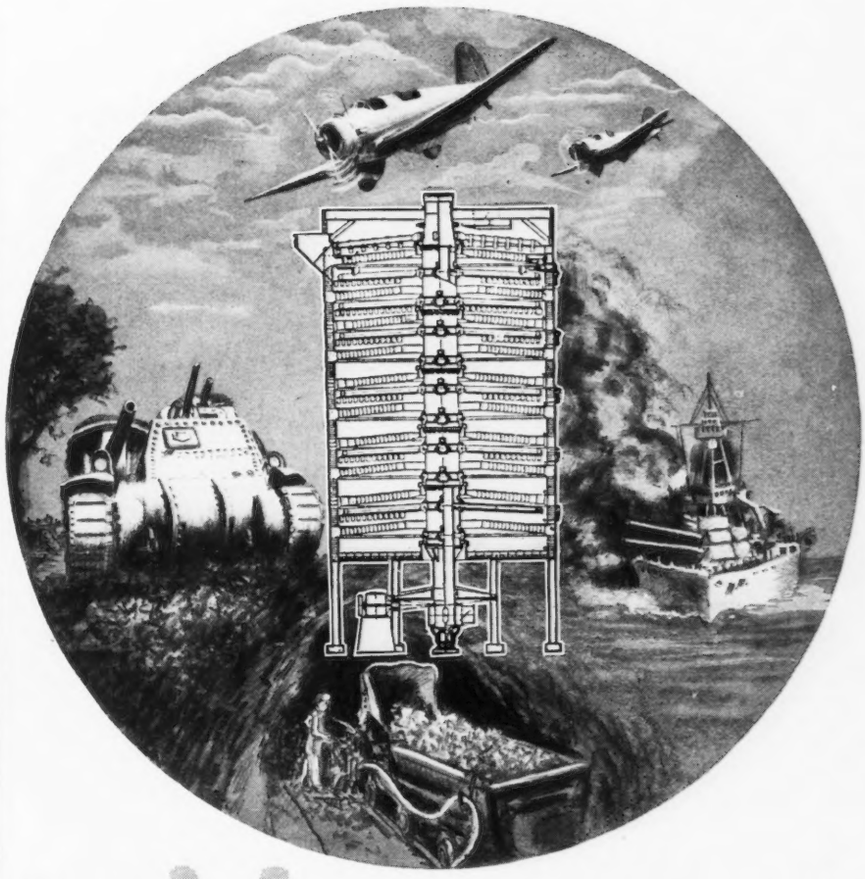
VENEZUELA

War Demands Spur Mining Activity

Shortage of equipment threatens—Asbestos plant nears completion—Mercury deposit into production

▶ Mining in Venezuela has shown more activity in the last few months than at any other time in the last decade. The establishment last December of a free dollar exchange has reassured the gold miners, and new war demands have stimulated prospecting and development in essential materials. However, the only materials actually produced in quantity have been gold, cement, and diamonds. Considerable prospecting and development work have been carried on in all mining areas. Production is expected in the near future of magnesite, iron ore, asbestos, and some mercury.

▶ Venezuelan economy depends directly on the United States, and the restriction of transportation caused by the withdrawal of ships to direct war work and by submarine warfare is stimulating those enterprises that produce for the Venezuelan market and discouraging the production of bulk materials for export. Thus, cement and asbestos producers (a great proportion of the lower grades will be consumed internally) are being benefited, and oil production has dropped. Of course, the power of life and death over any mining enterprise in this country lies with the U. S. Government in its exercise of priorities that are required for equipment.



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▶VENEZUELA

▶ Michael J. Messel, manager of the El Tigre asbestos mine, at Tinaquillo, State of Cojedes, reports that his plant is 70 percent completed. It is designed to treat 960 tons of serpentine per day, producing 6,000 tons of asbestos fiber per year. Diamond drilling has greatly increased the quantity of visible ore. Reserves are now calculated at over 6,000,000 tons. Provided the arrival of machinery is not delayed, production should commence this year.

▶ Preliminary studies for operation are being carried on at the Loma de Guerra magnesite mine, on the Island of Margarita. The old railroad is being replaced by trucking approaches to the principal quarries. The company claims over 6,000,000 tons reserve of silica-free magnesite ore at quarries Nos. 1, 2, and 3 alone.

▶ Dr. Manuel Tello, of the geological service of the Ministry of Fomento, has completed diamond drilling of the Santa Ana, Paraguana, chromite deposit. The results were somewhat disappointing, for the orebody appears to contain only about 5,000 tons.

▶ Progress is reported on the highway being built by the Bethlehem Steel Co. from its El Pao iron mine to its port of Palua near San Felixe on the Orinoco River. This road is intended mainly to serve as a means of building the projected railroad. The harbor is being improved, camps are being built, and an airfield is being prepared.

▶ Gold production has dropped slightly because of the rush of alluvial miners to the Surukun diamond fields. However, lode mining is normal, although it is feared that a decline will occur unless equipment is made available from the United States. The French Mucopia Mining Co. has more than quadrupled its ore reserves since a year ago, and has paid back to the Venezuelan Government the loan received for development. The company hopes to complete its new inclined shaft this year and to increase its production rate to 100 tons per day. The total gold production for 1941 was 4,055,325 grams, of which New Goldfields produced 3,317,156 grams and French Mucopia 287,523 grams. Both these companies are operating in the El Callao district; the former obtains most of its production from the Columbia mine, an enclave in the properties of New Goldfields.

▶ The San Jacinto quicksilver mine, near Carora, State of Lara, has proceeded with development and exploration. A ten-pipe retort has been constructed and operation began in March. Some difficulties in retorting were encountered because of the high content of hydrocarbons in the ore.

▶ Dr. Victor Lopez, geologist for the Ministry of Fomento, and Dr. Carlos Delgado, Director of Mines, have undertaken a study of the Aroa copper property, in the state of Yaracuy. This mine was shut down in 1931. It is now filled with water and partly caved, but reports turned in to the Venezuelan Government during the time of operation indicate that some ore reserves remain. The new El Palito-Palma Sola railroad links the mine directly to the port of Puerto Cabello.

▶ In accord with the policy of making Venezuela as self-sufficient as possible, plans are being formulated for the construction of two cement plants—one in eastern and the other in western Venezuela. Good-quality limestones abound in the country, so that the location of the plants will be determined by such factors as ease of transportation and the availability of labor and power.

▶ In 1941 the diamond placers produced 29,399 carats, of which 78 percent came from the Surukum River in the Great Savannah (southern part of the State of Bolivar), and the remainder from the lower Caroni.

▶ The manganese deposit near Guigue has been reported by the Department of Mines to contain a rather small tonnage.

▶ Some prospecting has been accomplished on the nickeliferous ultrabasic intrusives west of Caracas, but as yet no deposits comparable to those in Brazil have come to light.

▶ Venezuelan mining is adjusting itself to war conditions and will benefit, provided that the gold mines can be kept operating. Transportation to the United States and the availability of equipment are the most important factors in the development of the industry. The Venezuelan Government is becoming increasingly interested in mining, and Dr. Delgado, Director of Mines, is building an organization that will assist as well as control mining activity.

BRAZIL

Strategic Mineral Exports to U. S. Greatly Increased

New aluminum plant announced—Expansion of ferronickel output being considered —New activity in lead and zinc

▶ The Brazilian mineral industry is growing steadily at an ever-increasing rate. Scarcity of several metals and minerals at home, and the requirements of the U. S. for several raw materials which used to be imported from countries outside the Western Hemisphere, are the main reasons for this growth.

Last year exports reached a new all-time level of 487,802 contos (some $24,000,000), a 220 percent increase over 1940. Prominent items were diamonds, rock crystal, manganese and iron ores, and mica.

▶ The Brazilian mineral industry is playing an active part in the defense of the hemisphere, supplying the U. S. a large list of products which are vital to the prosecution of the war effort. The importance of Brazilian contributions has increased since U. S. imports from Asia, Africa, and Australia were restricted in consequence of the prevailing situation in the Far East. As only a small fraction of the country's mineral resources are being exploited, one can expect considerable further increases of production.

▶ Diamonds were the main item in the export statistics last year; 64,309 grams, with a value of 147,915 contos, were exported in 1941, compared to only 81,403 contos in 1940 and 39,456 contos in 1939.

▶ Rock crystal showed the greatest increase in value, jumping from 1,103,021 kg. (27,862 contos) in 1940 to 1,979,599 kg. (98,797 contos) in 1941.

▶ Manganese ore exports were twice as large as in 1940. Exports were 437,402 tons in 1941, chiefly to the U. S., against 222,713 tons in 1940. New mines are in operation this year and exports may be greater if shipping difficulties do not increase.

▶ Although exports of mica were only 867,068 kg, in 1941, against 1,117,474 in 1940, the value reached last year the new high of 23,844 contos, being only 15.755 in 1940.

▶ Pressed by the actual scarcity of metals, some of which are vital for the country's own requirements, several undertakings are under way: It is announced that the Companhia Brasileira de Aluminio, a recently organized concern with a capital of 60,000 contos, will soon build a 4.000-ton aluminum reduction plant. The company owns large mines of high-grade low-silica bauxite in southern Minas Geraes. The alumina and reduction plants will be erected close to Sorocaba, near Sao Paulo, and the ore will be shipped by rail to the plant. The company controls a promising mine of fluorite, discovered a few months ago in the southern edge of the sulphide belt of Ribeira de Iguapa valley. Before the new discovery, only minor occurrences of fluorite were known in the country. Extensive timbered areas around the plant and ample facilities of hydroelectric power are reported as favorable conditions for operation. Construction is actively under way. Another aluminum plant is also under construction in Ouro Preto, Minas Geraes. Local high-grade bauxite will be used. An adequate supply of power is also reported in that area, which was formerly an important gold producer.

▶ Companhia Niquel do Brasil is producing ferronickel at the plant in Livramento, Minas Geraes. The ore is garnierite, related to basic intrusives in the gneissoid country rocks. Dr. L. J. Moraes, head of the Departamento Nacional da Producao Mineral, Rio de Janeiro, estimates mine reserves at 6,000 tons of 5 percent grade, 300,000 tons of 2 percent grade and a substantial reserve of lower grade ore. Mining started in 1936, when 28,000 tons were mined, most of which was exported. Ferronickel is produced in an electric furnace with a capacity of 15 tons of charge per day and is of 20 percent Ni grade. Limestone and iron ore are used as fluxes. Power consumption averages 1,300 kwh. per ton of charge, or 14,500 kwh. per ton of ferronickel produced. Power is supplied by the company's own hydroelectric power plant, located 6 miles away. Ample facilities for further expansion are reported and the installment of 80-ton per day furnaces is under consideration.

▶ Because of the restriction of exports of zinc from the U. S., it is getting exceedingly difficult to obtain the country's

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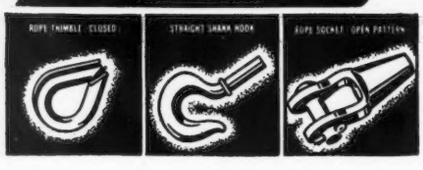

▶ BRAZIL

requirements. Difficulties of importing have increased since the outbreak of war in the Pacific. Even before, stocks were small and high prices have prevailed since the end of 1939. Under the pressure of such circumstances much interest is being aroused in further exploitation of native zinc ores. Laminacao Nacional de Metais, which operates a large rolling mill near Sao Paulo, is building a pilot plant to produce electrolytic zinc. Production is to start soon and ore is to be supplied by several mines in northern Minas Geraes and southern Sao Paulo.

▶ No lead ores were exported last year, in consequence of the completion and operation of a small lead smelter in Apial, Sao Paulo, where the ore produced in the lead-zinc belt can be treated and the refined metal sold in Sao Paulo. Brazilian consumption of lead is growing fast, having jumped from some 6,000 tons in 1935 to a new all-time high of 19,740 tons in 1941. Brazilian production of lead is still very small because of the lack of equipment at the mines.

MEXICO

U. S. Price Agreement Encourages Mexicans

New developments undertaken in several areas—Labor unions pledge cooperation—Transportation improvements begun

▶ The outlook for Mexican mining is definitely brighter as a result of agreements for considerable American financing and the prospect of better prices for this country's metals and minerals in the United States. News of this pact was very stimulating. But there is a general opinion in the executive department of the industry that benefits will not be immediate, for several reasons. Transportation, particularly rail, and especially that of the government-run National Railways, must be considerably bettered so that mining can get its products to market promptly and on a sustained basis. The obstacles must be erased to obtain machinery and equipment, all of which now must come from the United States. This is an urgent necessity to make Mexican mining function. Labor, long a chronic problem for this most important Mexican business, must be brought into line.

▶ However, there are some good signs of these stumbling blocks being lessened, if not entirely removed. The government is really doing something about getting the National Railways into condition by obtaining rolling stock from American manufacturers and reconditioning locomotives and cars in its shops —an important step, as this is Mexico's greatest railroad. The government, also, is concentrating on building roads and fixing up existing highways to serve key mining regions. There are high hopes that Washington will make it possible for Mexico to get mining machinery and equipment as well as material to patch up such items that are in service, and

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labor has given indications of being more reasonable. One such indication is the decision of the miners' union not to demand in future that extra workers must have the same rating as the permanent staff; also that all miners shall regard as part of their job work that is necessary on each shift, and go easy with overtime and extra service pay demands.

▶ Cananea Consolidated Copper, Cananea, Sonora, has made labor peace for what appears to be at least the duration with a contract that will be in force indefinitely from next Sept. 12. It features a general daily pay increase of 1 peso and 1.50 pesos more a day for special service employees. Other privileges are retirement on pension of workers who are either very old or chronically ill, though their employment term may not be that which usually warrants retirement. The miners' union has assured the company of its complete cooperation in the program to increase and sustain production.

▶ Companies, individual operators, and prospectors are being encouraged by the Guanajuato government to intensify exploitation of the Veta Madre, a rich vein said to be 18 kilometers long, in Guanajuato. It has been only partly worked.

▶ Quarrels between two factions of cooperative miners that some time ago leased mines of Peñoles at Ojuela, Durango, have brought federal troops to prevent bloody clashes until the national labor authorities can settle the dispute.

▶ Several Mexican mining companies, names of which are not announced, have asked the federal and Durango governments for rights to exploit fluorite deposits discovered recently at Rodeo, Durango. All this fluorite, it is said, will be shipped to the United States.

▶ Help of the Hidalgo government and the Dos Carlos cooperative, pioneer society of the kind in Mexico, has been asked by the San Rafael cooperative, Pachuca, to get going again. The San Rafael has had to curtail work sharply because of its inability to pay an electric power bill and to buy equipment replacements.

▶ Mexican Candelaria, Contraestaca, Sinaloa, is proceeding with its work after the removal of labor difficulties that nearly resulted in a strike. The federal board of conciliation and arbitration permitted the company to lay off 50 workers when it checked and corroborated Candelaria's contention that this paring of personnel is necessary because of an economic depression. The miners' union was persuaded by the board to allow the dismissals. Each laid-off worker was indemnified to the extent of 80 days' pay, payment for yearly vacations, plus ten days' wages for every year of service. Candelaria will be permitted to dismiss 90 employees on a like compensation basis if its business does not take an upswing.

▶ Mining in general in Chihuahua and the Chihuahua City region in particular is to be benefited by reconditioning that President Manuel Avila Camacho has ordered for the Kansas City, Mexico & Orient Railway at a cost of 500,000 pesos ($110,000). The Mexican government assumed control of this railroad June 15, 1940, and has decided that the

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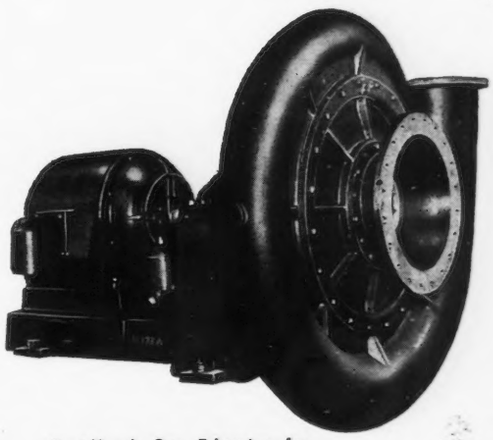

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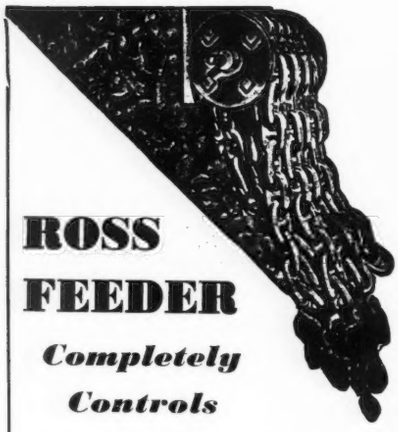

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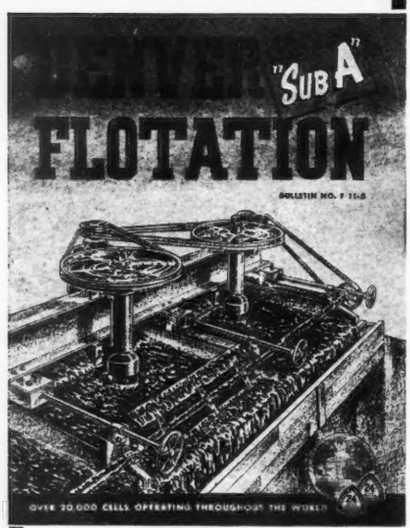

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right-of-way and rolling stock must be overhauled if it is to be a paying business. The improvements will include building two branches, one to link Chihuahua City with Estacion de Tabaloapa (5 kilometers) and the other from Estacion de Tabaloapa to Avalos (3 kilometers), where American Smelting & Refining has a unit and refinery.

▶ Prospectors have blazed the way to opening up workings of important gold, silver, antimony, tungsten, and mercury deposits in the Sahuaripa region, Sonora, according to the national commission for stimulation of the mining industry. It is understood that some Mexican companies plan a number of operations soon in the Sahuaripa area. Manganese mining has been increased at Mulege, Mexico, Baja California, the commission reports.

▶ American Smelting and Cia. Minera Tepic, S. A., the properties of which AS&R operates under lease, won a tax application suit in the Supreme Court that establishes a precedent. The court ruled that the Ministry of Finance was wrong when it fined Tepic for failing to report in its income-tax declaration money ASR had paid it for use of its properties. It was proved that ASR had deducted the sums due for income tax and settled in its payment. This ruling affects all mining companies in Mexico.

▶ Net profits of 87,787.03 pesos ($17,150) are reported for 1941 by Nueva Cia. Minera de la Cruz y Todos Santos, S.A., Pachuca, Hidalgo, whose properties Cia. Minera de Real del Monte y Pachuca, S.A., is working under lease. Cruz paid dividends of 50,000 pesos in 1941 and opened up several rich orebodies in workings at a greater depth than those it had formerly exploited.

▶ Japanese-owned fluorite mines at Axamixtla, Taxco, Guerrero, which have been idle since their owners were placed on the American black list, are soon to be worked by an unnamed Mexican company that is being organized in Mexico City, says the national miners' union. All fluorite mined will be shipped to the United States.

▶ El Potosi Mining paid 30,651.53 pesos ($6,315) to several workers of its Aquiles Serdan unit, Chihuahua, as indemnification for ending their labor contract.

▶ American Smelting and its four subsidiaries, Asarco, Kildun, Metalurgica Mexicana, and Cia. Carbonifera de Sabinas (coal) were among the 16 foreign and Mexican companies that won from the federal Supreme Court the upsetting of a measure of the Cardenas government, enacted Nov. 1, 1937. This law compelled them to regard teachers as regular employees and pay them wages. The federal labor law demands that all industrial and agricultural companies establish and maintain schools for children of their workers. These companies had fought this law almost from the time it was enacted. The Supreme Court held that the measure is unconstitutional and interpreted the labor law as specifying that companies need only found and support schools for their workers' children. The court ruled that the Ministry of Public Education must pay the teachers of these schools. This ruling set a precedent in these cases that is of far-reaching benefit to mining.

Venezuelan Gold

(*Continued from page* 73)

it contains numerous errors and I wish to draw attention to some of them. Several errors are apparently typographical, such as naming the State of Bolivar the "State of Bolivia"; also, the monetary unit of the country is the Bolivar, not the "Boliviano."

In the geological sketch map of El Callao district many of the names are incorrectly given and the geology is far from being as complete and detailed as it might be had the most recent plans been consulted. The diabase dike (Laguna dike) is in one part of the text named a "norite" and several other statements are also incorrect in the portion dealing with the geological features. Incidentally, it would be interesting to me to know in which mine Mr. Knox identified tourmaline in the gangue of the lodes.

Apparently this article was written following Mr. Knox's five-day visit to the district in the spring of 1941, when he escorted some Venezuelan students on a tour of the mining areas. One gets the impression that much of the information and some of the figures quoted result from an attempt to take mental notes of information given by various individuals in the course of this visit. For instance, the ore reserves of the New Goldfields of Venezuela Ltd. are far from correct. The official figures published in the annual reports for the past two years are as follows:

Ore reserves as at June 30, 1940, were 480,396 tons containing 9.60 dwt. per ton.

Ore reserves as at June 30, 1941, were 411,170 tons containing 9.88 dwt. per ton.

At no time has the ore reserve been as low as 300,000 tons.

The ore is hauled on surface and on datum level in cars of 31 cu.ft. capacity and underground in 18-cu.ft. Ottumwa cars. None of 1½-cu.yd. capacity are used.

Mr. Knox's own figures do not check. For instance, he states that 17,000 to 18,000 tons per month is treated, averaging 11.0 dwt. per ton mill heads, with extraction of 94 percent yielding about 8,000 oz. By calculation it appears the yield would be over 9,000 oz. However, the New Goldfields report for the period of which Mr. Knox writes (1941) gives the following figures:

"Tons milled 225,794, grade averaging 9.86 dwt/ton, gold recovered 103,846 ounces (extraction 93.1%)." At the time of his visit the mill was crushing approximately 20,000 tons per month (March 1941—19,834 tons) and the mines were sending 770 tons per day to the mill, as there is no productive work done on Sundays.

There is no company operating in Venezuela named the "Mocupia Mining Company," but presumably reference to La Compania Francesa de la Mocupia is intended. This company's milling capacity is 120 tons per day, to which the Columbia mine contributes about 90 tons. Two other mines help to complete the tonnage requirements—namely, La Santa Rosa and El Tigre. Mill extraction varies between 83 percent and 85 percent and could be improved by the adoption of flotation, but this cannot be effected at the present time. Development done during the past 18 months has increased the ore reserve by 400 percent.

The statement that the Laguna shaft is a two-compartment one is incorrect. Like all other shafts sunk by this company it is a three-compartment shaft and the bottom level is 600 ft. below datum. With reference to the Union Mine the report that "lenticular masses of vein matter occur in a wide band dipping and striking N. 60 deg. W." is an inaccurate description. Four orebodies were found in a wide shear zone, the general strike of which is N. 60 deg. E. and the dip is to the S.-E.

Again, in the same paragraph, the remark that "the hanging wall consists of slabs of silicified wall rock supported only by gouge," will surely surprise most engineers. All the oxidized ore in the Union and Sosa Mendez mines was removed by a specially devised system of square-set stoping, followed by filling, and the ground gave little trouble. It should also be noted that it is not correct to say that "each miner or mucker has a young helper paid by the company to aid him in his work"; only machinemen have helpers. The output per manshift compares favorably with that of native miners employed in West Africa and India but is about 35 percent of the amount produced by white miners employed in Californian gold mines.

The remarks made by Mr. Knox regarding the Exchange control may have been correct a year ago, but the following quotation from a letter sent to me by Dr. Carlos Delgado in December 1941 will describe the present position, which is obviously much more favorable to mining companies than formerly:

"At present the Venezuelan Government is trying to regulate and stabilize foreign currency under the terms of the President's decree of July 23, 1941. This decree establishes two markets for foreign exchange: (1) a controlled market by means of which the Banco Central buys all the exchange resulting from the operations of the oil companies at the rate of Bs3.09 to the U. S. dollar, selling only for specified imports, and payments are made through Government licenses at Bs3.35 to the dollar: and (2) there is also a free market which applies to the rest of the foreign exchange coming from the sales of gold, other exports, remittances, etc., where anyone can buy or sell at rates fixed by supply and demand. The Banco Central, however, intervenes to regulate this market when the rates get too high or too low by free selling or buying in it." Thus mining companies can sell their gold at the prevailing rate of exchange, which has varied recently from Bs3.50 to Bs3.90 to the U. S. dollar and is equivalent at present to Bs120.00 per ounce of gold. A further point, not mentioned by Mr. Knox, but an important one, is that mining companies can import all their explosives, machinery, spares, equipment for mine, mill, smelter and laboratory free of duty.

El Callao, Venezuela. J. C. DAVEY

The Editor:

I WISH TO THANK Mr. Paul A. Bundy and Mr. J. C. Davey for their interest in my article on the New Goldfields of Venezuela published in your March issue.

I agree with Mr. Bundy that "ironstone" is a possible substitute for my "laterite." I must take exception, however, to the suggestion of "basaltic agglom-

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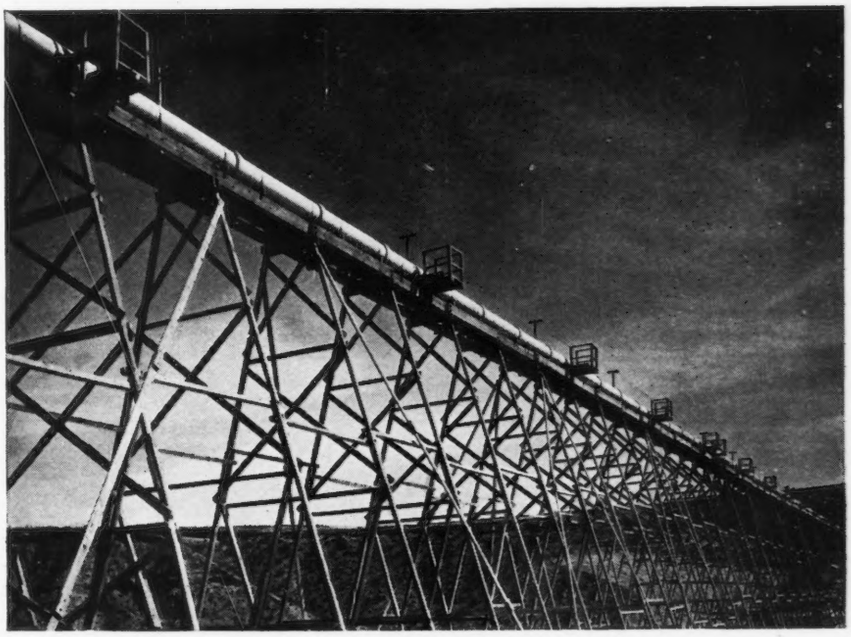

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erate"; this term brings to mind an igneous rock—pyroclastic material of basaltic composition. Such is far from the case; the material consists of concretions composed of hydrated iron oxides and clays, sometimes several inches long, cemented together by the same substances. It can form a superficial bed several feet thick or a discontinuous layer of isolated concretions. I have never seen an analysis, but the material is definitely a product of weathering and is derived in this case from the underlying greenstones. This same lateritic earth is found not only in Venezuelan Guiana but also on the fans that have been built up between the Venezuelan Coast Range and the Orinoco River hundreds of miles away. Its wide distribution has given rise to many interesting climatic and physiographic theories. Locally it is known as "moco de hierro" (iron slag), a term referring to its porous structure, but open to the objection that it is also used to refer to gossan and has a false association.

It must be remembered that Guiana is part of the Brazilian Shield and comparable in complexity of metamorphism and intricacy of structure to Ontario and Quebec; few definite geological conclusions can be expected until the area has been studied in great detail. So far, unfortunately, neither the Venezuelan Government nor the mining companies have been able to undertake this.

The country rock referred to as "greenstones" has been the subject of much discussion. W. H. Newhouse and Guillermo Zuloaga *(Econ. Geol. Vol. XXIV, pp. 797)* refer it to the Pastora series, younger than the gneiss basement complex. They described tuffs, agglomerates, etc. Zuloaga has remarked that the greenstones can be traced laterally to easily recognizable dolomites. The first workers in the area named these greenstone "andesites," and belief in their igneous origin persists. It is based on textures, a few somewhat doubtful pillow structures exposed at El Salto, and on the tuff association. The principal minerals of the rock are quartz, chlorite, feldspar, and calcite—the latter often quite abundant. Although gold mineralization in the gneisses is not uncommon, it generally takes the form of great cylindrical chimneys of milky quartz containing slight but definite values in gold; persistent veins are rare. Greenstone seems to be a more favorable rost rock for formation of ore bodies.

The sketch map as given in the article is not as detailed as many which Mr. Davey and I have seen. Unfortunately, my field observations have led him to consider without value many of the distinctions mapped by some workers within the greenstones. Mr. Davey's quotation of Dr. Carlos Delgado's letter on the present exchange situation is correct. The current (May) free exchange rate is Bs3.40 to $1. The dollar has been falling for some time because of difficulties in purchasing U. S. commodities.

I close with the remark that Mr. Bundy is very highly thought of at New Goldfields and that Mr. Davey has established an enviable record in pulling the French Mocupia mining company's Columbia mine out of the difficulties it was experiencing when he took over as mine superintendent.

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PRESSED STEEL CAR CO., INC.
(Industrial Division)
PITTSBURGH, PA.

Tin Successfully Recovered From Old Tin Cans

A PROCESS for recovering tin and steel from used tin cans, requiring no preparation of the cans on the part of the householder or other users of canned commodities, can now be applied to large-scale production, according to an announcement by Walton S. Smith, vice president of the Metal & Thermit Corp. This company has been operating a test plant at San Francisco for the last five years.

"The pilot plant is a complete unit with a capacity of over 6,000 tons. From its operations, suitable methods have been worked out for the recovery of about 24 lb. of tin oxide and almost a ton of scrap steel per ton of discarded cans," Mr. Smith stated. "The tin oxide is readily smelted to a grade equivalent to Straits tin.

The San Francisco plant handles cans which are collected from the city of Oakland and nearby communities. It accepts empties just as discarded and does not require special preparation for collection. The processing unit comprises unloading equipment, inspection station, rotary screens for dirt removal, incinerator for charring cans to destroy fat, paper, lacquer, and other combustibles and to separate the carbonaceous residue, shredding and pre-washing equipment, storage facilities, and complete equipment for continuous detinning by the alkali process.

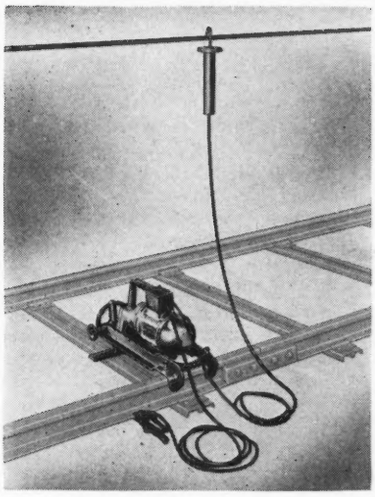
Rough estimates indicate that about 2,500,000 tons of tin can are discarded annually in this country and that about 1,000,000 tons of these could be economically collected and detinned, yielding about 11,000 tons of tin and 900,000 tons of scrap steel.

Detinning of tin-plate clippings obtained from can companies and other sources has been a well established industry for more than 30 years, but detinning of used cans has been impractical in peace times. Normally prices of both tin and steel scrap are comparatively low. Ordinarily, residual tin in scrap derived from cans is objectionable to steel mills. However, with imported tin no longer available and the present shortage of steel scrap, the usual objections do not hold and the used container can provide a source of worthwhile quantities of both metals here discussed.

The principal problems involved are those of collection, preparation, and transportation of cans. In areas where cans are to be collected for detinning, the cans would have to be kept separate from other refuse. It would also be advisable to shred the cans at collection centers so as to reduce their bulk for shipment to the plants. Location of plants of about 50,000 to 80,000 tons capacity near large centers of population appears the most practical solution to the transportation problem.

Announced plans to reduce by 50 percent the amount of tin going into containers would eventually reduce the amount of tin that could be recovered, but not for a year or two. In any event, the black sheet steel, which it is said will be substituted for tin plate in many of its present uses, could be reclaimed.

EQUIPMENT NEWS



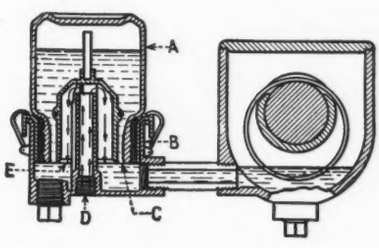
New Light-Weight Electric Rail Drill

ESPECIALLY DEVELOPED for use with wedge-type rail bonds, a new light-weight electric rail drill has been produced by the Ohio Brass Co., Mansfield, Ohio. Weighing less than 60 lb., the device is designed to drill a $\frac{5}{8}$- or $\frac{3}{4}$-in. hole in the web of a 40-lb. mine rail in approximately 40 sec. The drill motor operates on 250 volts d.c., and convenient connectors to rail and to trolley wire are supplied. The drill is fed into the rail web by means of a hand-operated screw feed.

Drilling height is adjustable for rail from 20 to 90 lb., and the rear of the assembly is supported by an adjustable platform which compensates for rough bottom conditions. The drill may be skidded along the rail from joint to joint, or if necessary, may be carried by means of the hand-grip provided.

Oil Feed Regulator

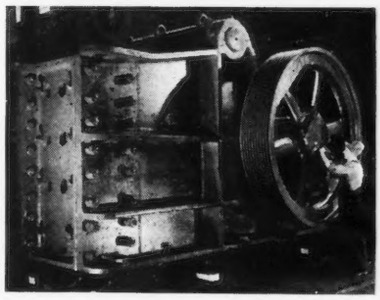
FOR USE ON ELECTRIC MOTORS, pillow blocks, pumps, fans, and gear boxes, a new oil-feed regulator has been introduced by Oil-Rite Corp., Milwaukee, Wis. The device is said to insure adequate lubrication at all times but to prevent oil waste by over-lubrication.



The accompanying diagram shows an application of the regulator to a bearing requiring an ample supply of oil. Position of the lower edge (C) of the oil reservoir (A) determines the level of oil in the bearing box. Dropping the bearing oil level allows air to enter the vent (D) and permits oil to flow down from the reservoir until the air vent is sealed off once more. The Oil-Rite Lubricator is furnished in four standard sizes of 2, 4, 8, and 16 oz., and can be adapted to a wide variety of installations. Complete details will be furnished by the manufacturer.

Radiation Pyrometer

BRISTOL CO., Waterbury, Conn., has developed a new radiation pyrometer, known as the Pyrovac, designed to register or to control automatically temperatures above 900 deg. F. When used in furnace or kiln work, the Pyrovac is said to be capable of measuring the temperature of the heated object itself rather than the furnace temperature surrounding the work. To accomplish this, the temperature-sensitive head of the instrument is mounted outside the furnace where it picks up heat rays only from the object under measurement.

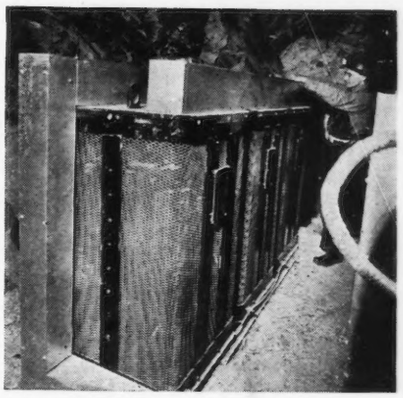


Allis-Chalmers Manufacturing Co., Milwaukee, Wis. announces a rock crusher of an entirely new design. This new unit is said to contribute materially to economy of operation and an increase in capacity. The machines are built with rolled steel, welded side frames to obtain greater strength and less weight. The crusher has a receiving opening 48x42 in.

New Product Inhibits Weld Spatter

SPATTERING MOLTEN METAL from the arc during welding can be prevented it is said, from adhering to surrounding metal surfaces by a new product of Acme White Lead & Color Works, Detroit, Mich. Sprayed or brushed on the work prior to welding, the preparation forms a resistant coating which tends to reject the spatters of metal otherwise found marring surfaces adjacent to welded seams. No time is lost after welding in grinding off this excess metal and the appearance of the job may be improved as well.

This product, known as Industrial Finish Flash-Off No. 99, conducts electricity and is said to produce stronger welds by aiding the formation of proper arc conditions. Inquiries should be addressed to Department FS-21, of the company mentioned.



Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., reports that its air-cooled, fireproof transformers in sizes 150 to 500 kva. are entering the underground mining field. Above are shown three Westinghouse 150-kva. air cooled transformers underground in a California gold mine.

Blackout Alarm Control

CERTAIN MANUFACTURING PLANTS particularly on the East and West coasts, have experienced difficulty in securing immediate reaction by their employees to night air-raid alarms because exterior signals could not be heard above the interior noise level of the plant. Photoswitch, Inc., Cambridge, Mass., has developed a photo-electric control for use in these cases. Trained on a street light outside the plant, the control actuates an interior alarm system should the street light be extinguished in a blackout. With this warning, plant blackout regulations can then immediately be put into effect.

Protective Coating

A NEW PROTECTIVE COATING that is said to be proof against all acids and all alkalies in any concentration and at any working temperatures has been announced by Protective Coating, Inc., 10391 Northlawn, Detroit, Mich. Known as "Chempruf," it serves as a coating or lining for acid tanks, fume ducts, storage and processing tanks, and for all surfaces, including ceramic, that must be protected against destructive reagents; also for pipe linings and many other applications for the protection of containers or their contents. It comes in two types, Type "A," being a brush-on heavy liquid, and Type "B," a plastic that hardens to withstand heavy-duty service and is applied only by the firm's own men.

pH Test Paper

SAID TO BE USEFUL in quick preliminary tests or in plant control work, the new Cargille Buffer Set, No. 1, provides reference solutions for determination of hydrogen ion concentration in half units from pH 3 to pH 11. Combined with Cargille pH test paper, the set affords an inexpensive method of pH measurement in applications where more precise apparatus is not required. Complete details may be obtained from R. P. Cargille Co., 118 Liberty St., New York City.

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SUCTION PUMP

Portable Suction Pumps can be used under all conditions where compressed air is available.

- These patented pumps are automatic, light in weight, easy to install and maintain.
- No cost for excavating sumps, no lubrication, no rotating parts.
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Where control of feed improves efficiency—as in weighing feed of ores to ball mills—the Merrick FEEDOWEIGHT gives perfect results. Weighs and Regulates separately. Continuously totalizes weight. Gives better control of grind. Used and approved by leading mill properties. Simple — rugged—"foolproof."

FOR BETTER CONTROL

BULLETIN 551 FOR DATA

MERRICK SCALE MFG. CO.
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Metal-Lead Primer

AS AN ALTERNATIVE to aluminum paint priming, the Midland Paint & Varnish Co., of Cleveland, Ohio, offers a metal-lead primer which, because of its metallic, non-rusting components, is claimed to be equal in its protective value to that of a good grade of aluminum paint. It is known as Hyspar.

INDUSTRIAL NOTES

American Zinc, Lead & Smelting Co. announced the appointment of **M. K. Easy** as sales engineer for the American Zinc Co. He has been in the employ of the company since 1921, in connection with the pigment sales and operating staff at Columbus, Ohio.

Taylor-Wharton Iron & Steel Co., New York, announces the promotion of **J. A. Krugler** from general sales manager to vice president in charge of sales and purchases. **J. L. Lonergan** has been appointed superintendent of the company's plant at Easton, Pa.

Macwhyte Co., Kenosha, Wis., reports the annual meeting of employees and stockholders at which service certificates were awarded to those who have completed 5 to 25 years of service. Gold watches were given to 25-year men.

Fairbanks, Morse & Co., Chicago, Ill., announces the payment of nearly $500,000 bonus to the company's factory and office employees, exclusive of salesmen, branch house managers, and others who are on bonus contracts. This is the fourth year of the profit-sharing plan.

B. F. Goodrich Co., Akron, Ohio, has issued an 11x17½-in. wall poster complete with metal eyelet for easy hanging, giving rules for the conservation of rubber. It is entitled "You Must Save Rubber."

Cloud Wampler, executive vice president of Carrier Corp., Syracuse, N. Y., announces the resignation of **Carl A. Ostling** as production vice president of the air-conditioning company. Mr. Ostling is leaving to become director of industrial engineering for the United States Rubber Co., with which he was formerly associated.

W. D. Bronson has been appointed district manager for the Chicago area by K. R. Beardslee, sales manager, Carboloy Company, Inc., Detroit. Mr. Bronson, formerly assistant manager in Chicago, succeeds **W. W. Fullagar,** resigned. **Einar Almdale,** of the General Office Sales Engineering Department, has been transferred to the Chicago District as a tool service engineer.

Allis-Chalmers, Milwaukee, Wis., announces that **Walter Geist** has been elected president of the company, replacing **W. C. Buchanan,** whose resignation due to ill health was reported a few weeks ago. Mr. Geist began work with Allis-Chalmers as an errand boy in 1909 and has since built up an impressive record of achievement. He is most widely known for his leadership in the development of the multiple V-belt, or Texrope, drive.

Caterpillar Tractor Co., Peoria, Ill., announces the appointment of **Gail E. Spain** as vice-president in charge of the San Leandro, Calif., office. **John Q. McDonald** has been promoted to general sales manager, replacing Mr. Spain.

Meehanite Metal Corp., Pittsburgh, Pa., has granted manufacturing rights for Meehanite castings to **Otis Fensom Elevator Co., Ltd.,** Hamilton, Ontario. The manufacturing of war equipment for the Dominion of Canada makes up a large part of the present activities of this organization.

Copperweld Steel Co., Warren, Ohio, reports that **Howard W. Broecker** has been appointed assistant district manager for the Chicago area. **N. H. Brodell** has become metallurgical sales engineer for the same company.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., reports that **Andrew H. Phelps,** manager of purchases and traffic, has been elected to the rank of vice president. Mr. Phelps joined Westinghouse in 1937, coming from McGraw-Hill Publishing Co., where he served as sales manager and director of public relations. Also promoted to vice president were **L. E. Osborne,** manager of the steam division; **Frank C. Reed,** president of Westinghouse Electric Elevator Co.; and **Walter C. Evans,** general manager of radio, X-ray, and broadcasting divisions. The Westinghouse Company has also organized a new maintenance sales department to help keep "7,000,000 Westinghouse motors and generators running full time in the nation's busy industrial plants and power houses." **Harry R. Meyer** has been made sales manager of this department, which will coordinate the sale of renewal parts and repairs.

Worthington Pump Co., Harrison, N. J., announces the election of **Charles Neal Barney,** of Scarsdale, N. Y., a vice president of the corporation. Mr. Barney joined the company in 1918 and has since served as treasurer and as head of the legal department.

Harnischfeger Corporation, Milwaukee, Wis., has inaugurated a "Beat the Schedule" program as a stimulant to its production of cranes, electric hoists, and excavators. Workers' committees cooperate with management in devising methods of shortening production time of vital equipment.

Navy "E" pennants have recently been awarded to the following corporations: **Broderick & Bascom Rope Co.,** St. Louis, Mo.; **Rome Division, Revere Copper & Brass Inc.; Nordberg Mfg. Co.,** Milwaukee, Wis.; **Jeffrey Mfg. Co.,** Columbus, Ohio; and **Electric Storage Battery Co.,** Philadelphia, Pa. These awards are made by the Navy only to those plants which have demonstrated unusual efficiency and excellence in the production of war materials.

BULLETINS

Steel Products Manual. American Iron and Steel Institute, New York City, has revised its bulletin on carbon steel semi-finished products which is Section 2 of the Steel Products Manual. This pamphlet defines and classifies the various carbon steel shapes and gives accepted specifications of standard steels.

Electrical Apparatus. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., announces the publication of the April 1942 revision of the **Quick Selector Catalog**

covering safety switches, no-fuse breakers, multi-breakers, panelboards, motor-controlled units, and motors. New application data have been included. Copies of this catalog, No. 30-000, may be secured from Department 7-N-20 on request.

Hydroclassifier. Bulletin No. C4A-B of the Denver Equipment Co., Denver, Colo., describes a new hydroclassifier which features clean sand-slime separation at sizes as fine as 100 mesh. The use of spiral rakes and controlled washing of the sands is said to provide more efficient operation.

Conical Ball Mills. Hardinge Co., York, Pa., Bulletin No. 13-D describes completely the operation and application of Hardinge conical ball mills together with all accessory equipment, such as gears, feeders, liners, balls, and pebbles. A section is also devoted to dry grinding and to wet and dry classification apparatus.

Recording Meters. A list of bulletins covering a wide range of uses and possible applications of graphic instruments may be obtained from the Esterline-Angus Co., Inc., Indianapolis, Ind.

Conserving Conveyor Belting. Catalog Section 2800, furnished by B. F. Goodrich Co., Akron, Ohio, outlines numerous methods of lengthening the life and usefulness of rubber conveyor and elevator belting. This bulletin, as well as other similar Goodrich publications, should be of value in conserving present conveyor installations.

New Welding Technique. Lincoln Electric Co., Cleveland, Ohio, announces a bulletin describing a new technique called Fleet-fillet Welding, which is said to permit faster fillet welding at lower cost.

Safety Equipment. Bulletin G-5 of Mine Safety Appliance Co., Pittsburgh, Pa., describes a complete line of safety and first-aid equipment necessary for war-time plant protection.

Care of Rubber Hose. Wall cards detailing the proper care of rubber hose may be had on request to Manhattan Rubber Mfg. Division, Passaic, N. J.

Production Engineering. A booklet entitled, **More Production, Better Morale,** issued by Bedaux Co., Chrysler Building, New York City, describes methods by which production engineering can be of value in increasing output of war-time industry.

Reconditioned Mining Machinery. Stock List No. 421, issued by Morse Bros. Machinery Co., Denver, Colo., contains the latest complete list of the company's stocks of rebuilt and reconditioned mining and metallurgical equipment.

Silent Non-metallic Gears. Manufacture, uses, and specifications of Fabroil and Textolite gears are described in a bulletin obtainable from the Plastics Department, General Electric Co., Pittsfield, Mass. Silent operation and long-wearing qualities are features of these gears.

Ohmite Resistors. Ohmite Mfg. Co., Chicago, Ill. Catalog No. 18, contains specifications and general information regarding Ohmite rheostats, resistors, tap switches, chokes, and attenuators.

Pedestal Welder. Progressive Welder Co., East Outer Drive, Detroit, Mich., has issued bulletin No. 501, describing the operation and design of a new welder, and illustrating the application of spot welding.

Mining and Materials-Handling. R. G. LeTourneau Inc., Peoria, Ill., announces a new 12-page illustrated folder, No. A-282, showing the company's complete line of mining and materials-handling tools on some of the largest mining operations throughout the world.

Patching Cement. Smooth-On Manufacturing Co., Jersey City, N. J., has published a folder on a new quick-hardening iron cement for patching concrete floors.

Temperature Indicators. The Foxboro Co., Foxboro, Mass., has just issued a new bulletin describing its line of potentiometer indicators and indicating resistance thermometers. Ask for Bulletin No. A-305.

Jaw Crushers. Alloy Steel & Metals Co., Los Angeles, Calif., has issued Bulletin 116, illustrating and describing Pacific jaw crushers.

Spray Nozzles. The Deister Concentrator Co., Fort Wayne, Ind., has published a folder describing water spray-nozzles for use on vibrating screens.

Victory Book. Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has published an illustrated brochure to show what products the company is making under war-time conditions. A sound-track moving picture dealing with the same subject is scheduled for early release.

the practical side of mining—**BY ATLAS**

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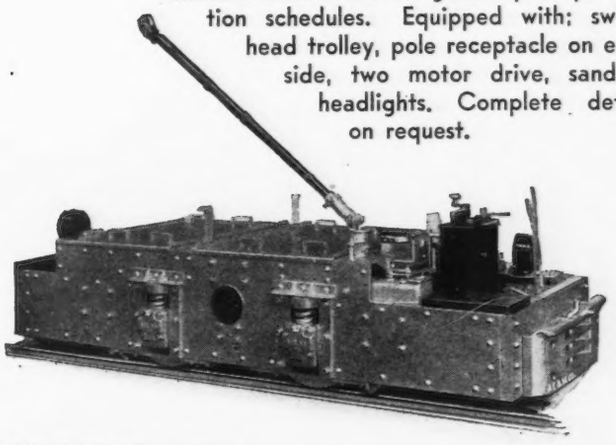

4-Ton Atlas Trolley Locomotive

THE ATLAS CAR & MFG. CO.
★ **CLEVELAND, OHIO, U. S. A.** ★

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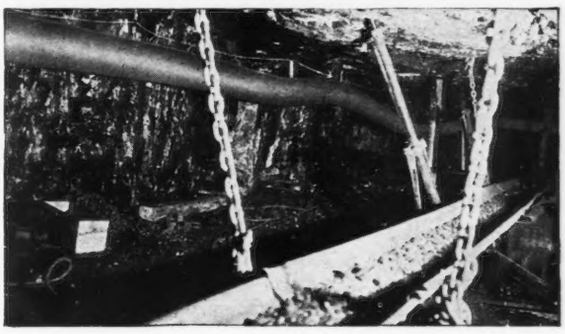

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Use the tubing that will best suit your conditions by choosing one of MINE VENT's four grades of tubing.

No matter what your conditions may be, MINE VENT will furnish inexpensive, dependable, ventilation for you . . . Rapidly installed by use of the newly developed demountable split coupling.

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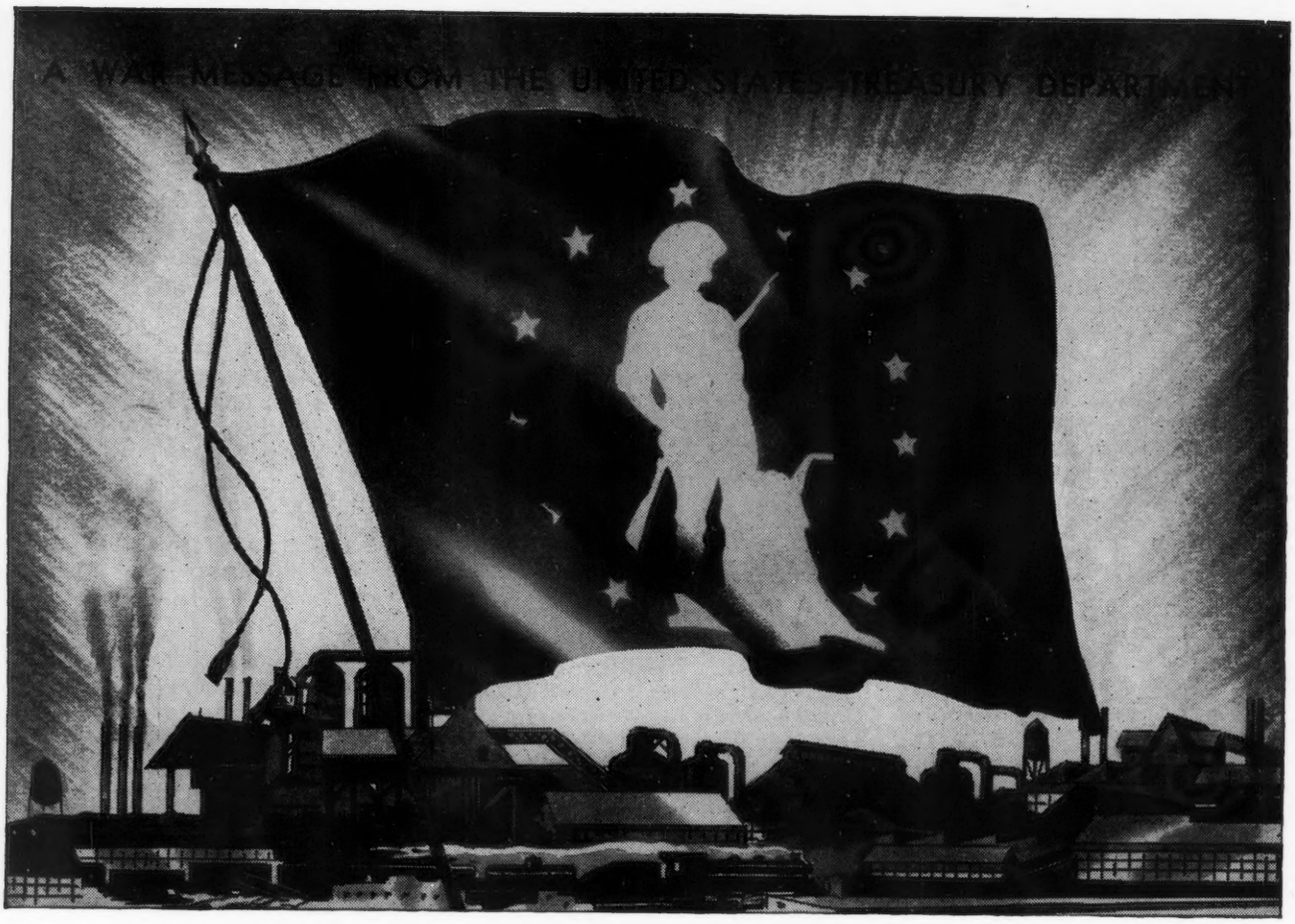

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IT doesn't go into the smoke of battle, but wherever you see this flag you know that it spells Victory for our boys on the fighting fronts. To everyone, it means that the firm which flies it has attained 90 percent or more employee participation in the Pay-Roll Savings Plan . . . that their employees are turning a part of their earnings into tanks and planes and guns *regularly,* every pay day, through the systematic purchase of U. S. War Bonds.

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If your firm has already installed the Pay-Roll Savings Plan, now is the time to increase your efforts: (1) To secure wider participation and reach the 90-percent goal; (2) to encourage employees to increase their allotments until 10 percent or more of your gross pay roll is subscribed for Bonds. "Token" allotments will not win this war any more than "token" resistance will keep our enemies from our shores, our homes. If your firm has yet to install the Plan, remember, TIME IS SHORT.

Write or wire for full facts and literature on installing your Pay-Roll Savings Plan now. Address Treasury Department, Section D, 709 12th St., NW., Washington, D. C.

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U. S. GOVERNMENT PRINTING OFFICE 16—27879-1 Form No. DSS-BP-4

Legendary "White Metal" and Its "Ore"

AS A BYPRODUCT of its investigations, the Metallurgical Division of the U. S. Bureau of Mines, from time to time is requested to identify rocks that are usually submitted in good faith by prospectors, miners, and others who think they may contain elements of value, according to C. W. Davies in the Bureau's Information Circular 7205. In the large majority of instances, cursory inspection or a few simple tests reveal the nature of the barren material, and the Bureau's statement that the material is worthless is ordinarily accepted. Sometimes it is not so easy to convince the hopeful prospector, especially if he has made tests or has been told of experiments that apparently show the presence of some valuable substance. One of the most difficult persons to convince is the seeker of "white metal."

There is a legend that Mexicans and other old settlers in the Southwest knew of an ore that could be used to harden iron or steel. The usual procedure was to heat the metal in contact with the ore by means of a wood fire, then quench in water. Axles of springless wagons so treated were said to have been made "glass hard" and to wear two or three times as long as ordinary axles, and tires so treated were described as "ringing like a bell" when suspended and struck with a hammer. This effect was believed to be due to a "white metal" that was extracted from the ore and alloyed with the iron by the treatment.

Although this story has never been shown to have had any basis in fact, it still appears from time to time under slightly different guises. Consequently, various laboratories, at different times during the past 30 years, have received many kinds of rocks (designated as ores) that are supposed to give remarkable properties to metals, such as making them glass hard, extremely tough, or resistant to corrosion. The "ores" submitted include altered diabase, olivine, pyroxenite, obsidian, basalt, amphibolite, pyritic quartzite, magnetite, tourmaline, sandstone, and, in fact, almost every known rock. The majority of samples come from California and Nevada, but nearly all Western States are represented.

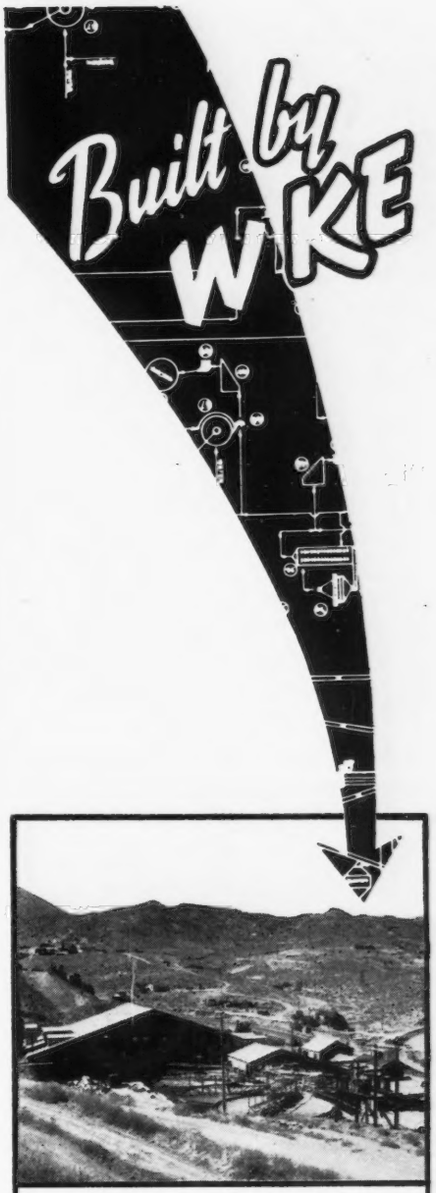
Mr. Davis acknowledges the cooperation of those who so kindly informed him of the results of their investigations so that these results might be included in this circular. Harry E. Tufft, formerly of the Bureau of Mines, assisted in preparing the original manuscript.

Results of Tests—In the method of treatment usually specified the metal is heated in contact with the rock for the expressed purpose of producing an alloy with the "white metal." Suggested heat-treating temperatures have ranged from 200 deg. F. to that of the electric arc. The favorite heating device is the blacksmith's forge. Extraction of the "white metal" (which, it was said, could be used directly in forming an alloy, for example, by putting a little on a knife blade and heating in a bunsen flame) was described as having been performed by simply melting the "ore," by melting it with fluxes, or by melting it with fluxes and a reducing agent.

In the past, laboratories of the Metallurgical Division have received various samples of this nature. Some of the samples were brought to the Bureau in person by the sponsor, who attempted to demonstrate his process. Results indicate that money expended for investigation of the mysterious white metal and its ore would be wasted.

Tests by the Bureau and other laboratories, following specified procedures, usually have shown that the ores have no outstanding hardening effect, although in a few tests case-hardening resulted either from heating the metal in contact with carbon, which was protected from oxidation by a coating of flux, or from the formation of a crude silicon alloy. Many ordinary fusible rocks, and even fluxes without rock, will give the same results. Some of the claims of glass hardness may be traced to an adherent hard slag that was mistaken for hardened metal. This coating frequently imparted increased resistance to corrosion.

For example, it was alleged that a particular powdered ore, when sprinkled on Norway iron and heated in a forge, would coat the metal with a lustrous, glass-hard, non-corrodible material and that the iron would change to steel. A treated specimen was submitted to the Bureau of Mines laboratory at Berkeley, Calif. Analysis showed the ore to be obsidian. A small bar of Norway iron was packed in the powdered mineral and heated electrically above the fusion point of the



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mineral *in the absence of carbon*. The submerged part acquired a brilliant, silverlike luster but was not hardened or changed in any other way. Apparently, the effect was merely a thorough cleansing of the surface, which doubtless would be less corroded than a surface more or less coated with iron oxide. The alleged glass-hardness of the submitted specimen was shown to be due to small masses of the fused mineral adhering to rough spots on the surface of the metal.

In another test the ore was basalt, and very positive claims were made for its hardening effect. In the attempted demonstration quarter-inch square bars of Norway iron were heated bright red in a forge and dipped in the powdered mineral, this process being repeated until the end of the bar was well-coated with slag. When quenched in water, the coated portion showed a lustrous surface, and when the bar was twisted this part was found to be slightly hardened. The effect, however, was due to case hardening caused by particles of coke that were not only held in contact with the iron but also protected from oxidation by the coating of fused mineral. Many similar results have been readily explained, leading to the conclusion that claims concerning the action of these ores are largely unsound.

Attempts to extract white metal from such ores, following specified directions, usually have failed to yield any metal, except when the treatment called for high-temperature fluxing with charcoal of a rock that contained considerable iron, in which instance a small quantity of metallic iron was produced. Invariably, the specimens of white metal said to be melted from the ore were impure metals, mostly lead, copper, zinc and iron, or simply slag. In testing some rocks it was found that the lead had been introduced by fluxing the rock with charcoal in an old assay crucible that had contained a little slag high in lead, which was reduced to metallic lead. In some specimens, the lead, copper, or zinc had been introduced as impurities in the fluxes used for treating the ore or by using a container in which these metals were present, for example zinc from galvanized iron.

It was claimed that one sample of pulverized ore (volcanic rock), when melted with flux in an electric arc with carbon electrodes, would produce white metal that would harden steel, iron, and copper. A test using a carbon ladle as container showed the white metal to be iron.

Another claim was that white metal could be produced by fusion in a carbon ladle as described, as well as by reduction in crucibles using fluxes and carbon. The product was said to harden copper or brass and to make cast iron malleable. Both of these methods were tested, using the carbon ladle in one and clay crucibles with fluxes of soda and borax, with and without the addition of carbon in the other. Without the use of the carbon ladle no metal was produced. With carbon a small quantity of metallic iron contained in the original ore was produced.

Other Tests

In several other tests the only metal produced from the ore was iron reduced from the rock by heating with carbon. Lead that had been introduced during extraction of the metal, either from impure fluxes or from the slag retained in old assay crucibles, was another metal commonly found.

One sample, extracted from a basic igneous rock, proved to be impure lead with a little tin and copper and resembled skimmings from molten solder. Another was impure lead that came from the forge where babbitt had been spilled. Still another was virtually pure lead reduced from the fluxes used.

To summarize, it may be said that all authentic tests have given results that may be adequately explained by the usual properties of the materials used. It must be concluded, therefore, that the various unsubstantial claims that have been made were due to careless tests, to erroneous interpretation of tests, or to an attempt to defraud.

I-T-E and the Mining Field

Pioneers In Electrical Protection

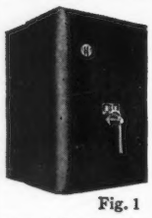


Fig. 1

Type KBA air circuit breaker for mining service, available for both a-c and d-c circuits.

Developments of the past ten years in mining methods have led to a very wide use of I-T-E air-immersed circuit breakers and switchgear. Consistent study of mining problems has kept I-T-E in the forefront with the result that I-T-E equipment has been a vital factor in mechanized practices. An example of I-T-E efforts to prepare for new needs is the Type KB circuit breaker (Fig. 1)—an extremely compact and rugged circuit breaker capable of meeting a wide variety of service conditions.

Automatic Reclosing Circuit Breakers

I-T-E automatic reclosing circuit breakers with load measuring characteristics are widely used in mines where d-c trolley and feeder systems are employed and where overload peaks and faults arise frequently. Type KSA is for substation use in protecting and controlling semi-automatic or full automatic M-G sets, rotary converters and mercury-arc rectifiers. Type KSC is used in sectionalizing service to localize faults. Sectionalizing provides for maximum production at reduced cost for power, for electrical maintenance and machine repairs.

Fig. 2

Fig. 3

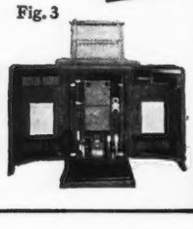
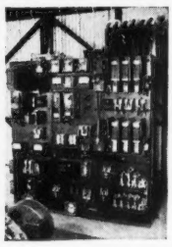


Fig. 2 (above) shows a Type KSA automatic reclosing circuit breaker for substation service. Fig. 3 (right) is a Type KSC automatic reclosing circuit breaker for sectionalizing service. Steel enclosure is open.

Automatic Switchboards For Mines

I-T-E has designed and built many switchboards in recent years for semi-automatic or full-automatic protection and control in connection with local generating systems or purchased energy. The switchboards are for service with M-G sets, rotary converters and mercury-arc rectifiers. Much of the equipment, including circuit breakers and protective relays, has been designed specifically for mining service. Mounting is simplified and there is much flexibility in space arrangements. A typical installation is at right, above. (Fig. 4.)



Load Distributors

I-T-E Type LDR Load Distributor improves service from two or more M-G sets or rotary converters in parallel on same system but widely separated. Generator loads are balanced to prevent over-heating, outages are reduced, peaks are limited and life of system and connected equipment prolonged.

Fig. 5

Type LDR Load Distributor, panel mounted, in glass front, dust-proof cover.

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Although under certain favorable conditions it is possible to effect a hardening or alloying action or to extract metallic iron from some rocks, the difficulty of obtaining reproducible results and of controlling the composition of the alloy would make the practicability of such procedures doubtful. Well-known methods are available that can be exactly controlled.

Test Work Done on Luna County Manganese

A SAMPLE of low-grade ore from the Manganese Valley mine, in the Little Florida Mountains, Luna County, New Mexico, was treated by two ore-dressing procedures. Each method yielded ferromanganese-grade products with recoveries of 76.3 and 79.4 percent of the contained manganese. The work is described in U. S. Bureau of Mines Report of Investigations 3620, by F. D. DeVaney, M. M. Fine, and S. M. Shelton.

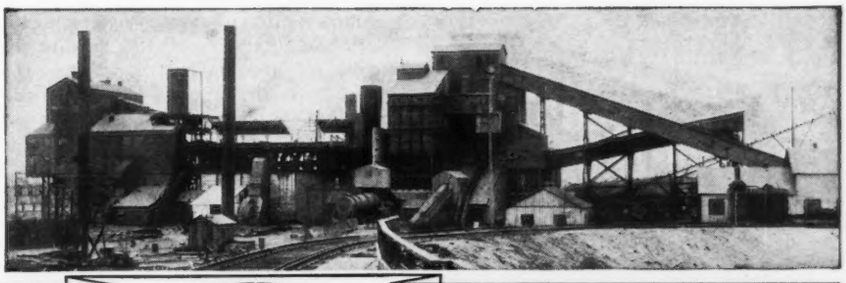
The tabulated results for the first procedure indicate that a long ton (2,240 lb.) of ore assaying 14.7 percent manganese, 3.4 percent iron, 48.6 percent silica, and 0.04 percent phosphorus will yield: (1) 513 lb. of ferromanganese-grade sinter assaying 49.3 percent manganese, 6.7 percent iron, 2.9 percent silica, and 0.06 percent phosphorus and containing 76.3 percent of the total manganese; (2) 1,694 lb. of tailings assaying 4.6 percent manganese, 2.5 percent iron, and 64.3 percent silica and containing 23.7 percent of the total manganese; (3) 33 lb. of volatile matter lost in sintering.

The second method of concentration would yield: (1) 540 lb. of ferrograde product assaying 49.3 percent manganese, 4.7 percent iron, 4.5 percent silica, and 0.09 percent phosphorus and containing 79.4 percent of the total manganese; (2) 1,678 lb. of tailings assaying 4.1 percent manganese, 2.9 percent iron, and 64.2 percent silica and containing 20.6 percent of the total manganese; (3) 22 lb. of volatile matter lost in sintering.

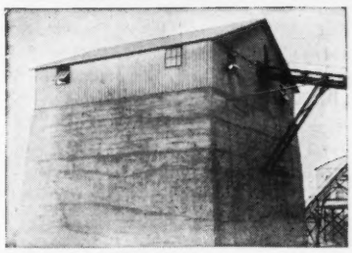
Although the two methods produced concentrates of virtually the same grade, the second method yielded a slightly higher recovery of ferrograde product. Of interest also is the fact the second method requires less sintering but more fine grinding and flotation.

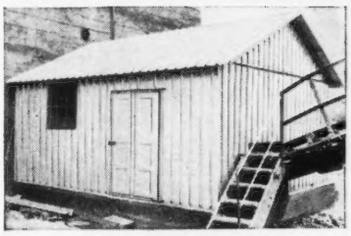
Tungsten Near Bishop, California

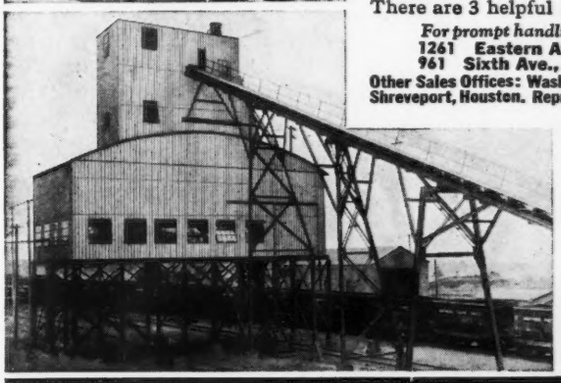
SCHEELITE OREBODIES occur at widely separated localities in the Sierra Nevada near Bishop, Calif. The scheelite is found in altered sedimentary rocks at or near the contact between granitic rocks and limestones that are partly changed to silicate rocks composd largely of garnet.



BUTLER READY-MADE STEEL BUILDINGS







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Mineralization was closely connected with the intrusion of the granite, the latest of the varied intrusives that make up the rocks of the Sierra Nevada.

The deposits in the High Sierra, at altitudes of 10,000 to 13,000 ft., are now the most productive and contain large reserves. They are described by Dwight M. Lemmon in U. S. Geological Survey Bulletin 931-E. They occur along the borders of a discontinuous septum of metamorphic rocks which extends along the crest of the Sierra Navada for nearly 50 miles. The great vertical extent of parts of this septum exposed in deep canyons indicates that some of the orebodies may extend to many hundreds or even to thousands of feet in depth.

The Pine Creek mine of the United States Vanadium Corp. has a larger proved reserve of tungsten than any other mine in this country, and now has a mill capable of producing annually at least 2,500 tons of concentrate, containing 60 percent of WO_3, from low-grade ore. Proved reserves of milling ore on the property amount to several million tons. The combined reserve tonnage of all the other deposits described in this report is probably at least 750,000 tons containing about 0.5 percent of WO_3, and these reserves will presumably be increased by downward development of the known deposits and discovery of new oreshoots. These estimates are based on surface exposures, for most of the deposits are entirely undeveloped.

South Dakota Manganese Ore Is Studied

SAMPLES of manganese ore from Chamberlain, S. D., were examined by the U. S. Bureau of Mines, according to the Bureau's Report of Investigations No. 3613, and found to contain 0.5 to 3.5 percent of manganese in the form of concretionary nodules of mixed carbonates of manganese, lime, iron, and magnesium. The nodules comprised 5 to 16 percent of the total weight of the samples.

Kiln drying of the raw ore, followed by screening only or by screening, water slaking, and log washing, will provide fair recovery of the manganese-bearing nodules.

Partial drying of the ore, either by weathering or kiln drying, renders the shale susceptible to disintegration by slaking in water. Kiln drying is preferable to weathering because of the spalling and breaking action of a rotary furnace and the uncertainty of weathering conditions. Natural drying also would complicate mining and transportation operations.

A recovery of 60.9 percent of the total manganese can be obtained in a product assaying 17 percent manganese by screening the kiln-dried ore on a 1-in. vibrating screen.

Of the nodular manganese in the minus-1-in. portion of the kiln-dried ore, the major part was found in the minus-1-, plus-½-in. size. An additional 9.7 percent of the total manganese can be recovered by treating that product in log washers.

The minus-½-in. portion of the kiln-dried ore constitutes 66.7 percent of the total weight, and as less than 2 percent of the total manganese in the minus-½-in. portion is recoverable by the proposed methods of concentration, it would be advantageous to discard it.

Tests at the Salt Lake City station of the Bureau of Mines on the application of explosive shattering to treatment of the ore showed that the method is suited to separate nodules, as the shale is readily disintegrated and the breakage of nodules is virtually negligible. Forty-one percent of the total manganese was recovered on a ½-in. screen after two passes through the explosive-shattering machine. This product assayed about 16 percent manganese. An additional 20 percent was recovered by a third pass of the minus-½-in. ore through the machine, pulping, and wet-screening on 10 mesh. It is possible that by suitable adjustment of steam temperature the ore could be screened dry on 10 mesh. This product will assay about 14 percent manganese. Additional recovery on screens

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finer than 10 mesh is impracticable.

No method of treating the raw ore directly without first disintegrating the shale either by natural weathering or by artificially supplied heat, such as explosive shattering or kiln drying, was found that could be depended upon to give a fair recovery of clean nodules.

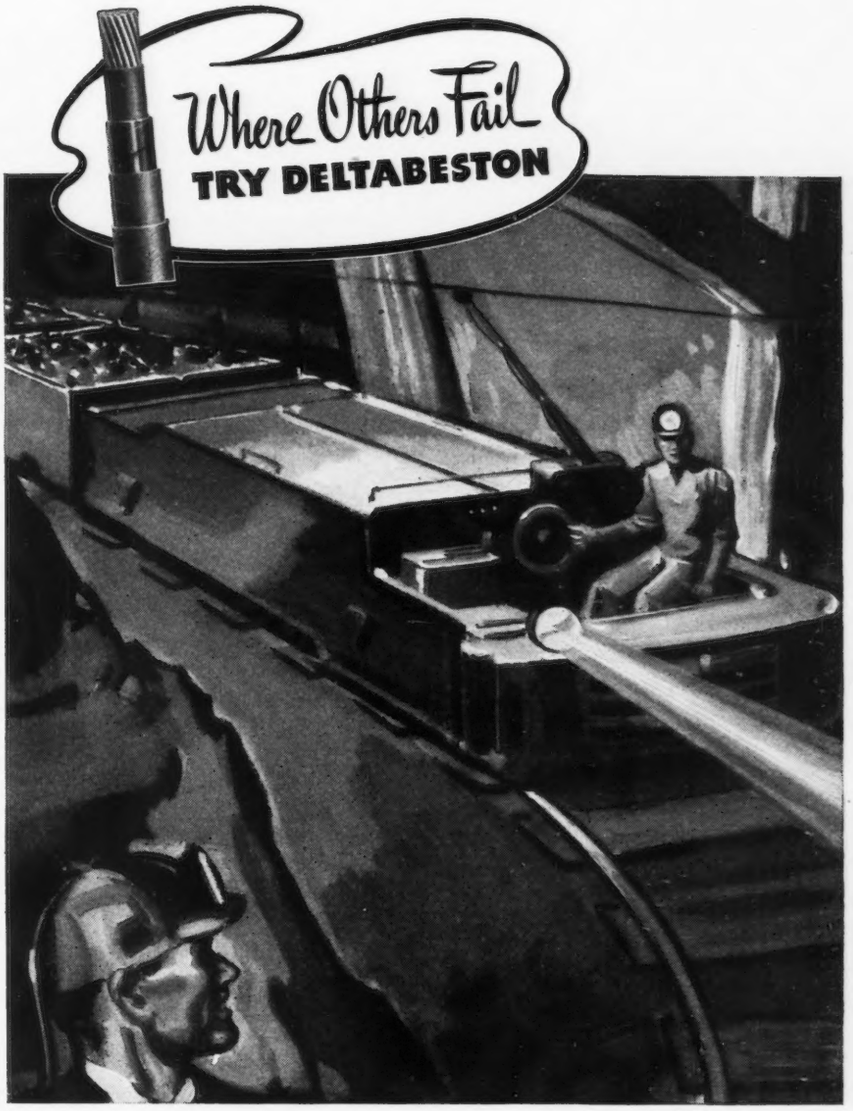
If the ore in place is scarified to a depth of about 1 ft., turned over at intervals, and allowed to weather for about 60 days, it is possible that the nodules can be recovered from the disintegrated shale by screening and log washing. Such a procedure means that the mining operations would be scattered over wide areas, the haulage system complex, and the entire operation dependent on the vagaries of the weather. If kiln drying is practiced the entire thickness of ore can be mined at once, and the transportation problem is greatly simplified. The kiln-drying process is under control at all times, and the kiln-dried product disintegrates more rapidly than an air-dried product.

Tin in Lander County, Nevada

TIN-BEARING VEINLETS are exposed in a small area near Izenhood Ranch, 22 miles north of Battle Mountain, Nev., according to Carl Fries, Jr., in U. S. Geological Survey Bulletin 931-L. They occur in thick rhyolithic flows of Miocene (?) age, and wood tin, found in the gravels of arroyos that head in the surrounding rhyolite, presumably comes from other veinlets not yet discovered. The exposed veinlets are about 20 ft. in maximum length and a quarter of an inch in average thickness. Parallel and reticulating veinlets form lodes 4 to 6 ft. thick and 15 or 20 ft. long. Virtually no cassiterite is disseminated in the wall rock.

The veinlets contain specularite, cassiterite, sanidine, andradite, cristobalite, tridymite, quartz, chalcedony, fluorite, and opal. All these minerals, except possibly cassiterite, together with topaz and pseudobrookite, are likewise present in cavities that are widely distributed in the rhyolite. The similarity of the mineral assemblage in the veinlets to that in the cavities indicates that the tin originated in the rhyolite magma, and spectrographic analyses indicate that the average rhyolite contains about 0.001 percent of tin. It is therefore believed that the incrustations were deposited in fumarolic vents along fissures formed by differential contraction during the cooling of the lavas.

There is no record of any production of tin from the area. Possibly a few tons of the metal might be produced from the exposed veinlets by narrow stoping and hand sorting. No large body of rock in the area, however, contains even 0.2 lb. of tin to the ton.



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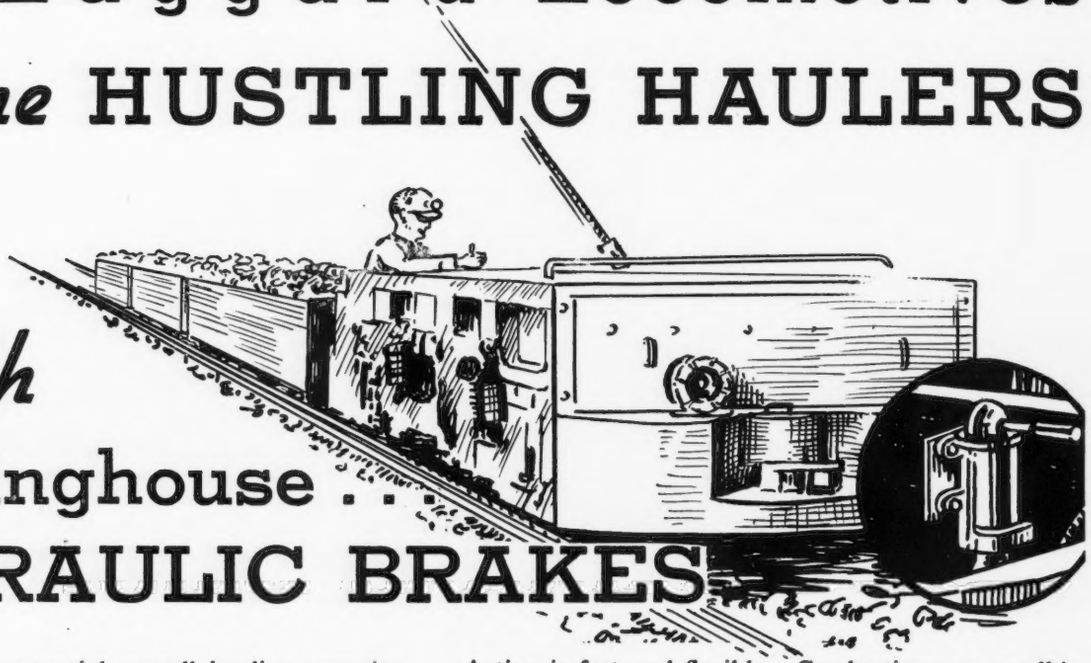

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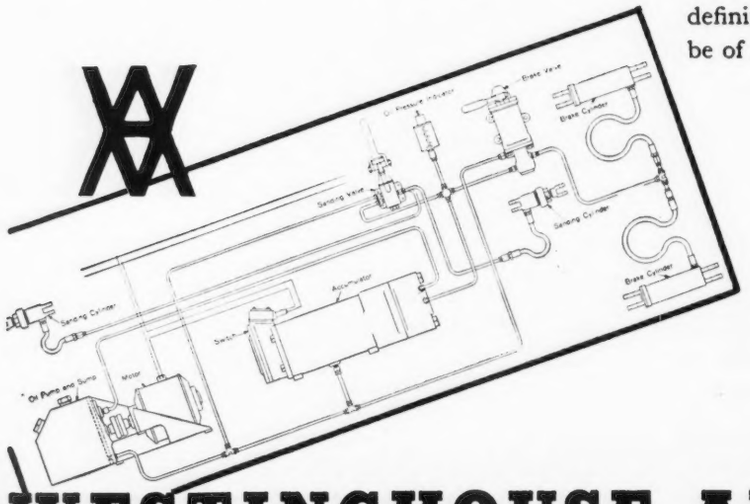

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